TEST REPORT

Product Name:	All in One Interactive Display
FCC ID:	M82XDS32-860
Trademark:	N/A
Model Number:	XDS32-860WI50OPAS1E, XDS32-750WI50OPAS1E XDS32-650WI50OPAS1E, XDS32-550WI50OPAS1E XDS32-***WI50OPAS** (* represents 0-10, A-Z.)
Prepared For:	Advantech Co Ltd
Address:	No. 1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 114, Taiwan R.O.C.
Manufacturer:	Advantech Co Ltd
Address:	No. 1, Alley 20, Lane 26, Rueiguang Road, Neihu District, Taipei 114, Taiwan R.O.C.
Prepared By:	Shenzhen CTB Testing Technology Co., Ltd.
Address:	Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Community, Xinqiao Street, Baoan District, Shenzhen, Guangdong China
Sample Received Date:	May, 11, 2022
Sample tested Date:	May, 11, 2022to May, 24, 2022
Issue Date:	May, 24, 2022
Report No.:	CTB220527056RF
Test Standards	47 CFR Part 15 Subpart E KDB 789033 V02r01
Test Results	PASS
Remark:	This is WIFI-5GHz band radio test report.

Compiled by:	Reviewed by:	Approved by:
Chen Zheng	Arron Liu	Bin Mei / Director

The test report is effective only with both signature and specialized stamp.This result(s) shown in this report refer only to the sample(s) tested. Without written approval of Shenzhen CTB Testing Technology Co., Ltd. This report can't be reproduced except in full. The tested sample(s) and the sample information are provided by the client.

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(Note: N/A means not applicable)

1. VERSION

Report No.	Issue Date	Description	Approved
CTB220527056RF	May, 24, 2022	Original	Valid

2. TEST SUMMARY

The Product has been tested according to the following specifications:

Test Item	Test Requirement	Test method	Result
AC Power Line Conducted Emission	47 CFR Part 15 Subpart E Section 15.407 (b)(9)	ANSI C63.10-2013	PASS
Radiated Spurious emissions	47 CFR Part 15 Subpart E Section 15.205/15.407(b)	KDB789033v02r01	PASS
Band edge	47 CFR Part 15 Subpart E Section 15.205/15.407(b)	KDB789033v02r01	PASS
Conducted Peak Output Power	47 CFR Part 15 Subpart E Section 15.407 (a)	KDB789033v02r01	PASS
Emission Bandwidth & Occupied Bandwidth	47 CFR Part 15 Subpart E Section 15.407 (a)(e)	KDB789033v02r01	PASS
Power Spectral Density	47 CFR Part 15 Subpart E Section 15.407 (a)	KDB789033v02r01	PASS
Frequency stability	47 CFR Part 15 Subpart E Section 15.407 (g)	KDB789033v02r01	PASS
Operation in the absence of information to the transmit	47 CFR Part 15 Subpart E Section 15.407 (c)	47 CFR Part 15 Subpart E	PASS
Antenna Requirement	47 CFR Part 15 Subpart E Section 15.203	ANSI C63.10-2013	PASS

Remark:
Test according to ANSI C63.4-2014 & ANSI C63.10-2013.

3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the Product as specified in CISPR 16-4-2. This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=2.

No.	Item	Uncertainty
1	Occupancy bandwidth	U=±54.3Hz
2	Adjacent channel power	U=±1.3dB
3	Conducted Adjacent channel power	U=±1.38dB
4	Conducted output power Above 1G	U=±1.0dB
5	Conducted output power below 1G	U=±0.9dB
6	Power Spectral Density , Conduction	U=±1.0dB
7	Conduction spurious emissions	U=±2.8dB
8	Out of band emission	U=±54Hz
9	3m camber Radiated spurious emission(30MHz-1GHz)	U=±4.3dB
10	3m chamber Radiated spurious emission(1GHz-18GHz)	U=±4.5dB
11	humidity uncertainty	U=±5.3%
12	Temperature uncertainty	U=±0.59℃
13	Supply volyages	U=±3%
14	Time	U=±5%
15	Conducted Emission (150KHz-30MHz)	3.2 dB
16	3m camber Radiated spurious emission(9KHz-30MHz)	4.8dB
17	3m chamber Radiated spurious emission(18GHz-40GHz)	3.4dB
18	Conducted Emission(150KHz-30MHz)	3.2dB

4. PRODUCT INFORMATION AND TEST SETUP

4.1 Product Information

Model(s):	XDS32-860WI50OPAS1E, XDS32-750WI50OPAS1E XDS32-650WI50OPAS1E, XDS32-550WI50OPAS1E XDS32-***WI50OPAS** (* represents 0-10, A-Z.)
Model Description:	All the model are the same circuit and RF module, only for model name. Test sample model: XDS32-860WI50OPAS1E
Wi-Fi Specification:	IEEE 802.11a/b/g/n/ac
Hardware Version:	V1.0
Software Version:	V1.0
Operation Frequency:	IEEE 802.11a/n/ac(20M): 5150MHz ~5250MHz/ 4 channel IEEE 802.11n/ac(40M): 5150MHz ~5250MHz/ 2 channel IEEE 802.11ac(80M): 5150MHz ~5250MHz/ 1 channel IEEE 802.11a/n/ac(20M): 5725MHz ~5850MHz/ 5 channel IEEE 802.11n/ac(40M): 5725MHz ~5850MHz/ 2 channel IEEE 802.11ac(80M): 5725MHz ~5850MHz/ 1 channel
Max. RF output power:	WiFi (5G): 15.919dBm
Type of Modulation:	WiFi: DSSS, OFDM, CCK
Antenna installation:	WiFi: External antenna
Antenna Gain:	WiFi: 1.0dBi
Ratings:	AC 120V/60Hz

4.2 Test Setup Configuration

See test photographs attached in EUT TEST SETUP PHOTOGRAPHS for the actual connections between Product and support equipment.

4.3 Support Equipment

Item	Equipment	Mfr/Brand	Model/Type No.	Series No.	Note
1.	Mouse	DELL	MS116c	/	AE
2.	Keyboard	DELL	KB216t	/	AE

Notes:

1. All the equipment/cables were placed in the worst-case configuration to maximize the emission during the test.
2. Grounding was established in accordance with the manufacturer's requirements and conditions for the intended use.

4.4 Channel List

For 802.11a/n/ac(20M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
36	5180MHz	44	5220MHz
40	5200MHz	48	5240MHz
For 802.11a/n/ac(20M) Operation in the 5725MHz ~5850 MHz band			
Channel	Frequency	Channel	Frequency
149	5745MHz	161	5805MHz
153	5765MHz	165	5825MHz
157	5785MHz	NA	NA

For 802.11n/ac(40M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
38	5190MHz	46	5230MHz
For 802.11n/ac(40M) Operation in the 5725MHz ~5850 MHz band			
Channel	Frequency	Channel	Frequency
151	5755MHz	159	5795MHz

For 802.11ac(80M) Operation in the 5150MHz ~5250 MHz band			
Channel	Frequency	Channel	Frequency
42	5210MHz	NA	NA
For 802.11ac(80M) Operation in the 5725MHz ~5850 MHz band			
Channel	Frequency	NA	NA
155	5775MHz	NA	NA

NOTE: Dutycycle>98%.

Test mode	rate
802.11a	54M
802.11n	500M
802.11/ac	500M

4.5 Test Mode

All test mode(s) and condition(s) mentioned were considered and evaluated respectively by performing full tests, the worst data were recorded and reported.

Test Mode	Tx/Rx	RF Channel		
		Low(L)	Middle(M)	High(H)
802.11a/n/ac(20M)	5150MHz ~5250 MHz	Channel 36	Channel 40	Channel 48
		5180MHz	5200MHz	5240MHz
802.11n/ac(40M)	5150MHz ~5250 MHz	Channel 38	N/A	Channel 46
		5190MHz	N/A	5230MHz
802.11ac(80M)	5150MHz ~5250 MHz	N/A	Channel 42	N/A
		N/A	5210MHz	N/A
802.11a/n/ac(20M)	5725MHz ~5850 MHz	Channel 149	Channel 157	Channel 165
		5745MHz	5785MHz	5825MHz
802.11n/ac(40M)	5725MHz ~5850 MHz	Channel 151	N/A	Channel 159
		5755MHz	N/A	5795MHz
802.11ac(80M)	5725MHz ~5850 MHz	N/A	Channel 155	N/A
		N/A	5775MHz	N/A

4.6 Test Environment

Humidity(%):	54
Atmospheric Pressure(kPa):	101
Normal Voltage(AC):NV	120V
Normal Temperature(℃):NT	23
Low Temperature(℃):LT	0
High Temperature(℃):HT	40

5. TEST FACILITY AND TEST INSTRUMENT USED

5.1 Test Facility

All measurement facilities used to collect the measurement data are located at Floor 1&2, Building A, No. 26 of Xinhe Road, Xinqiao Street, Baoan District, Shenzhen China. The site and apparatus are constructed in conformance with the requirements of ANSI C63.4 and CISPR 16-1-1 other equivalent standards.

5.2 Test Instrument Used

No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated date	Calibrated until
1	Spectrum Analyzer	Agilent	N9020A	MY52090073	2021.09.27	2022.08.05
2	Power Sensor	Agilent	U2021XA	MY56120032	2021.09.27	2022.08.05
3	Power Sensor	Agilent	U2021XA	MY56120034	2021.09.27	2022.08.05
4	Communication test set	R&S	CMW500	108058	2021.09.27	2022.08.05
5	Spectrum Analyzer	R&S	FSP40	100550	2021.09.27	2022.08.05
6	Signal Generator	Agilent	N5181A	MY49060920	2021.09.27	2022.08.16
7	Signal Generator	Agilent	N5182A	MY47420195	2021.09.27	2022.08.05
8	Communication test set	Agilent	E5515C	MY50102567	2021.09.27	2022.08.16
9	band rejection filter	Shenxiang	MSF2400-2483.5MS-1154	20181015001	2021.09.27	2022.08.05
10	band rejection filter	Shenxiang	MSF5150-5850MS-1155	20181015001	2021.09.27	2022.08.05
11	band rejection filter	Xingbo	XBLBQ-DZA120	190821-1-1	2021.09.27	2022.08.05
12	BT&WI-FI Automatic test software	Micowave	MTS8310	Ver. 2.0.0.0	2021.09.27	2022.08.05
13	Rohde & Schwarz SFU Broadcast Test System	R&S	SFU	101017	2021.09.27	2022.08.05
14	Temperature humidity chamber	Hongjing	TH-80CH	DG-15174	2021.09.27	2022.08.05
15	234G Automatic test	Micowave	MTS8200	Ver. 2.0.0.0	2021.09.27	2022.08.05

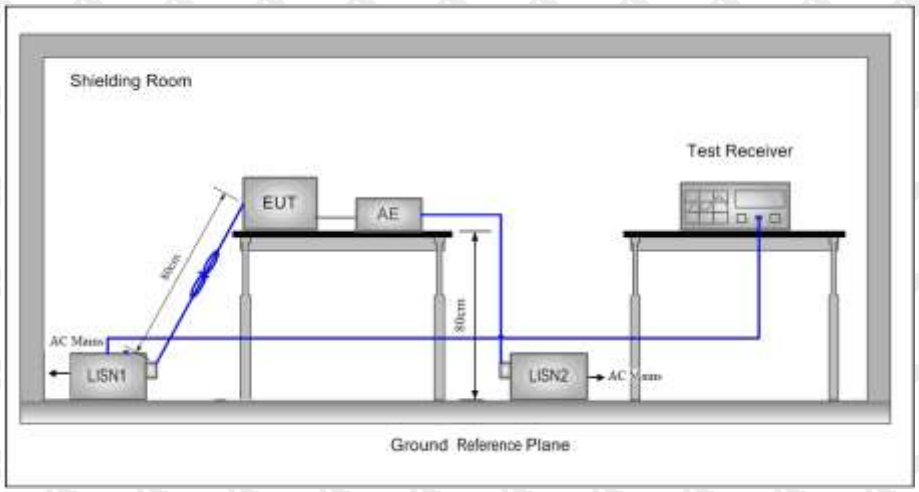
	software					
16	966 chamber	C.R.T.	966 Room	966	2021.09.27	2024.08.11
17	Receiver	R&S	ESPI	100362	2021.09.27	2022.08.05
18	Amplifier	HP	8447E	2945A02747	2021.09.27	2022.08.05
19	Amplifier	Agilent	8449B	3008A01838	2021.09.27	2022.08.05
20	TRILOG Broadband Antenna	Schwarzbeck	VULB 9163	869	2021.09.27	2022.08.07
21	Horn Antenna	Schwarzbeck	BBHA9120D	1911	2021.09.27	2022.08.08
22	Software	Fala	EZ-EMC	FA-03A2 RE	2021.09.27	2022.08.05
23	3-Loop Antenna	Daze	ZN30401	17014	2021.09.27	2022.08.05
24	loop antenna	ZHINAN	ZN30900A	/	2021.09.27	2022.08.05
25	Horn antenna	A/H/System	SAS-574	588	2021.09.27	2022.08.05
26	Amplifier	AEROFLEX	/	S/N/ 097	2021.09.27	2022.08.05

Continuous disturbance						
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated date	Calibrated until
1	AMN	ROHDE&SCHWARZ	ESH3-Z5	831551852	2021.09.27	2022.08.05
2	Pulse limiter	ROHDE&SCHWARZ	ESH3Z2	357881052	2021.09.27	2022.08.05
3	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESCS30	834115/006	2021.09.27	2022.08.05
4	Coaxial cable	ZDECL	Z302S	18091904	2021.09.27	2022.08.05
5	AAN	Schwarzbeck	NTFM8158	183	2021.09.27	2022.08.05
6	Communication test set	Agilent	E5515C	MY50102567	2021.09.27	2022.08.05
7	Communication test set	R&S	CMW500	108058	2021.09.27	2022.08.05
8	EZ-EMC	Frad	EMC-con3A1.1	/	/	/

Radiated emission						
No.	Equipment	Manufacturer	Model No.	Serial No.	Calibrated date	Calibrated until
1	Double Ridged Broadband Horn Antenna	Schwarzbeck	BBHA 9120D	1911	2021.11.01	2022.08.05
2	TRILOG Broadband Antenna	Schwarzbeck	VULB 9168	869	2021.11.01	2022.08.05
3	Amplifier	Agilent	8449B	3008A01838	2021.09.27	2022.08.05
4	Amplifier	HP	8447E	2945A02747	2021.09.27	2022.08.05
5	EMI TEST RECEIVER	ROHDE&SCHWARZ	ESPI7	100362	2021.09.27	2022.08.05
6	Coaxial cable	ETS	RFC-SNS-100-NMS-80 NI	/	2021.09.27	2022.08.05
7	Coaxial cable	ETS	RFC-SNS-100-NMS-20 NI	/	2021.09.27	2022.08.05
8	Coaxial cable	ETS	RFC-SNS-100-SMS-20 NI	/	2021.09.27	2022.08.05
9	Coaxial cable	ETS	RFC-NNS-100-NMS-300 NI	/	2021.09.27	2022.08.05
10	Communication test set	Agilent	E5515C	MY50102567	2021.09.27	2022.08.05
11	Communication test set	R&S	CMW500	108058	2021.09.27	2022.08.05
12	EZ-EMC	Frad	EMC-con3A1.1	/	/	/

6. AC POWER LINE CONDUCTED EMISSION

6.1 Block Diagram Of Test Setup



6.2 Limit

Table 4 – AC power-line conducted emissions limits

Frequency (MHz)	Conducted limit (dBµV)	
	Quasi-peak	Average
0.15 - 0.5	66 to 56[Note 1]	56 to 46[Note 1]
0.5 – 5	56	46
5 – 30	60	50

Note 1: The level decreases linearly with the logarithm of the frequency.

* Decreasing linearly with the logarithm of the frequency

6.3 Test procedure

1) The mains terminal disturbance voltage test was conducted in a shielded room.

2) The EUT was connected to AC power source through a LISN 1 (Line Impedance Stabilization Network) which provides a 50Ω/50µH + 5Ω linear impedance. The power cables of all other units of the EUT were connected to a second LISN 2, which was bonded to the ground reference plane in the same way as the LISN 1 for the unit being measured. A multiple socket outlet strip was used to connect multiple power cables to a single LISN provided the rating of the LISN was not exceeded.

3) The tabletop EUT was placed upon a non-metallic table 0.8m above the ground reference plane. And for floor-standing arrangement, the EUT was placed on the horizontal ground reference plane,

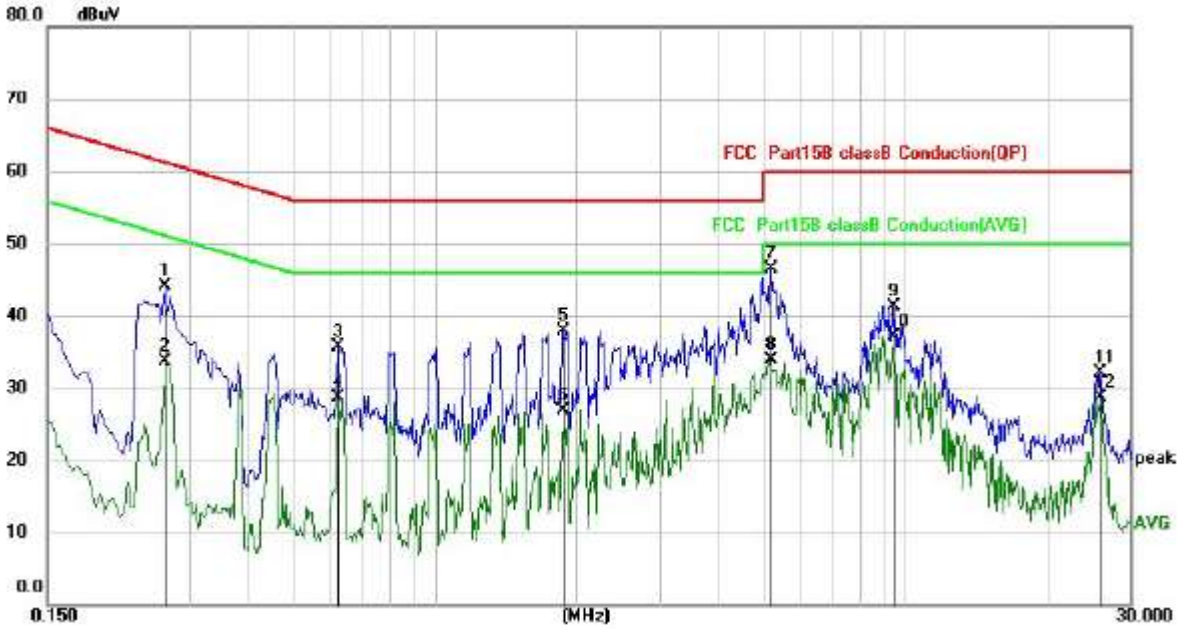
4) The test was performed with a vertical ground reference plane. The rear of the EUT shall be 0,4 m from the vertical ground reference plane. The vertical ground reference

plane was bonded to the horizontal ground reference plane. The LISN 1 was placed 0,8 m from the boundary of the unit under test and bonded to a ground reference plane for LISNs mounted on top of the ground reference plane. This distance was between the closest points of the LISN 1 and the EUT. All other units of the EUT and associated equipment was at least 0,8 m from the LISN 2.

5) In order to find the maximum emission, the relative positions of equipment and all of the interface cables must be changed according to ANSI C63.10 on conducted measurement**.**

6.4 Test Result

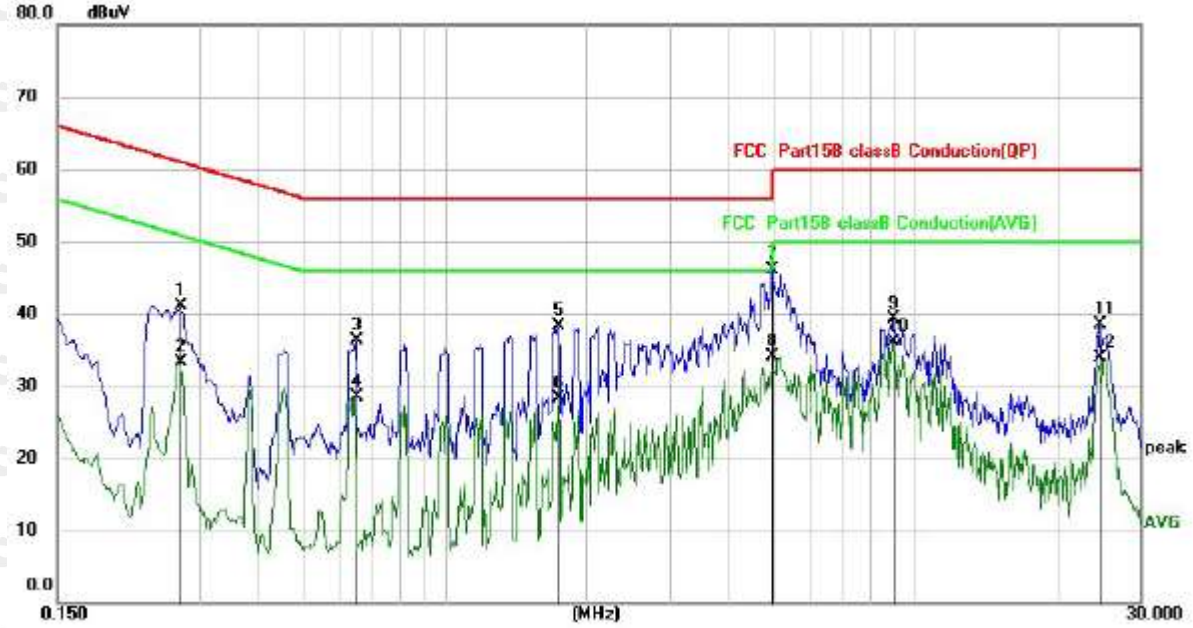
Test Specification: Neutral



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2660	34.06	9.96	44.02	61.24	-17.22	QP
2		0.2660	23.81	9.96	33.77	51.24	-17.47	AVG
3		0.6219	25.77	9.96	35.73	56.00	-20.27	QP
4		0.6219	18.83	9.96	28.79	46.00	-17.21	AVG
5		1.8660	27.98	10.01	37.99	56.00	-18.01	QP
6		1.8660	16.81	10.01	26.82	46.00	-19.18	AVG
7		5.1578	36.26	10.19	46.45	60.00	-13.55	QP
8		5.1578	23.76	10.19	33.95	50.00	-16.05	AVG
9		9.4018	30.66	10.72	41.38	60.00	-18.62	QP
10	*	9.4018	26.46	10.72	37.18	50.00	-12.82	AVG
11		25.8700	20.89	11.23	32.12	60.00	-27.88	QP
12		25.8700	17.52	11.23	28.75	50.00	-21.25	AVG

Remark:
Factor = Cable loss + LISN factor, Margin = Measurement – Limit

Test Specification: Line



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV	dBuV	dB	Detector
1		0.2740	31.20	9.96	41.16	61.00	-19.84	QP
2		0.2740	23.34	9.96	33.30	51.00	-17.70	AVG
3		0.6460	26.41	9.96	36.37	56.00	-19.63	QP
4		0.6460	18.64	9.96	28.60	46.00	-17.40	AVG
5		1.7419	28.34	10.00	38.34	56.00	-17.66	QP
6		1.7419	18.32	10.00	28.32	46.00	-17.68	AVG
7	*	4.9659	35.91	10.17	46.08	56.00	-9.92	QP
8		4.9659	23.96	10.17	34.13	46.00	-11.87	AVG
9		8.9579	28.64	10.67	39.31	60.00	-20.69	QP
10		8.9579	25.46	10.67	36.13	50.00	-13.87	AVG
11		24.6178	27.36	11.21	38.57	60.00	-21.43	QP
12		24.6178	22.68	11.21	33.89	50.00	-16.11	AVG

Remark:

1. Factor = Cable loss + LISN factor, Margin = Limit – Level
2. All modes were tested at AC 120V and 240V, only the worst result of AC 120V 60Hz was reported.
3. All the test modes completed for test. Only the worst result of was reported.

7. RADIATED SPURIOUS EMISSIONS

7.1 Block Diagram Of Test Setup

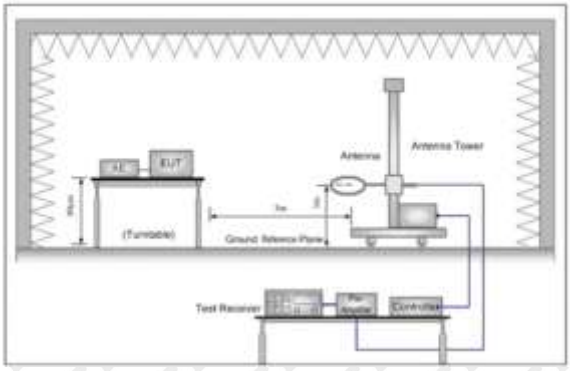


Figure 1. Below 30MHz

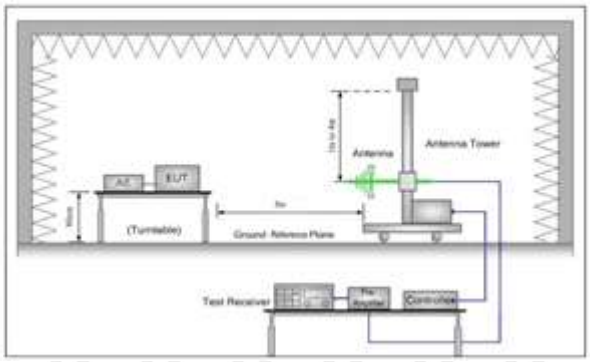


Figure 2. 30MHz to 1GHz

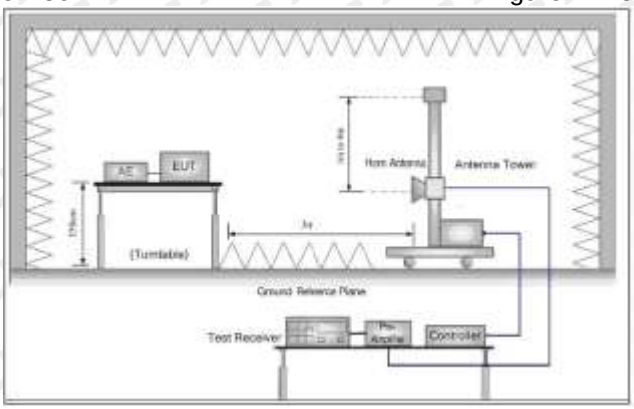


Figure 3. Above 1GHz

7.2 Limit

Spurious Emissions:

Frequency	Field strength (dBμV/m)	Remark	Measurement distance (m)
0.009MHz-0.490MHz	20log 2400/F (kHz) + 80	Quasi-peak	3
0.490MHz-1.705MHz	20log 24000/F (kHz) + 40	Quasi-peak	3
1.705MHz-30MHz	20log 30 + 40	Quasi-peak	3
30MHz-88MHz	40.0	Quasi-peak	3
88MHz-216MHz	43.5	Quasi-peak	3
216MHz-960MHz	46.0	Quasi-peak	3
960MHz-1GHz	54.0	Quasi-peak	3
Above 1GHz	54.0	Average	3

Note: 15.35(b), Unless otherwise specified, the limit on peak radio frequency emissions is 20dB above the maximum permitted average emission limit applicable to the equipment under test. This peak limit applies to the total peak emission level radiated by the device.

If radiated measurements are performed, field strength is then converted to EIRP as follows:
(i) EIRP = ((E*d)^2) / 30
where:
• E is the field strength in V/m;
• d is the measurement distance in meters;
• EIRP is the equivalent isotropically radiated power in watts.
(ii) Working in dB units, the above equation is equivalent to:
EIRP[dBm] = E[dBμV/m] + 20 log(d[meters]) - 104.77
(iii) Or, if d is 3 meters:
EIRP[dBm] = E[dBμV/m] - 95.2

7.3 Test procedure

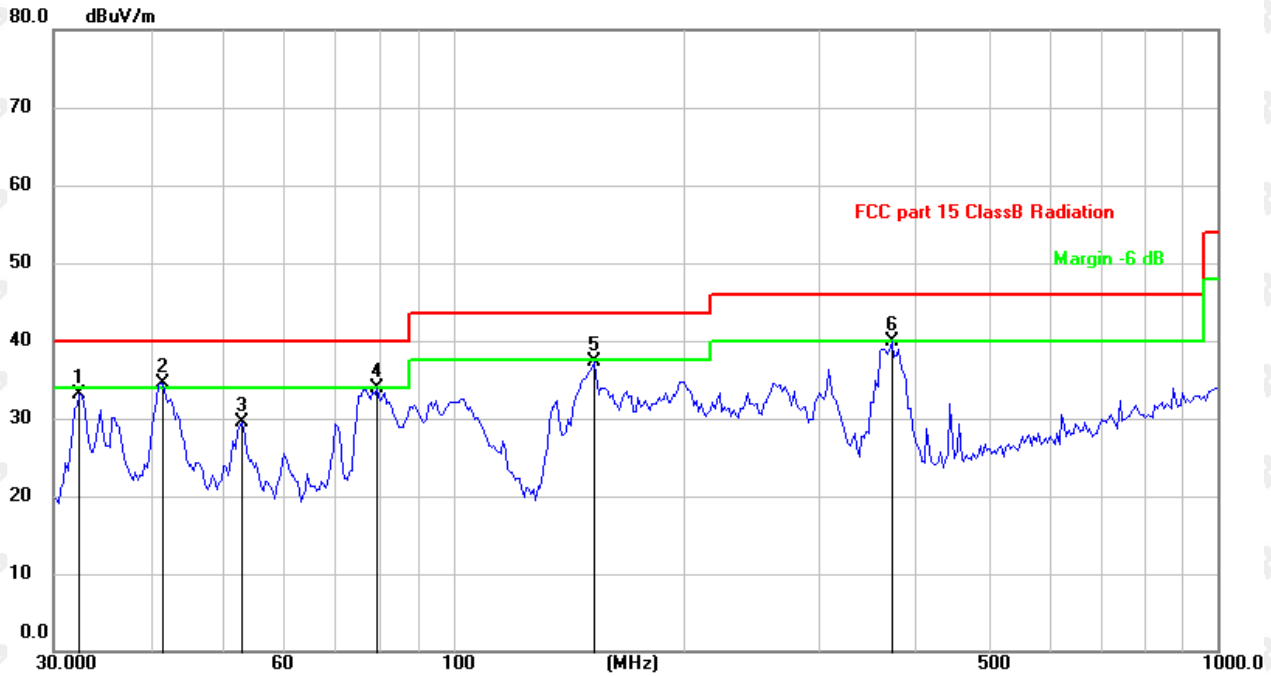
Below 1GHz test procedure as below:
a.The EUT was placed on the top of a rotating table 0.8 meters above the ground at a 3 meter semi-anechoic camber. The table was rotated 360 degrees to determine the position of the highest radiation.
b.The EUT was set 3 meters away from the interference-receiving antenna, which was mounted on the top of a variable-height antenna tower.
c.The antenna height is varied from one meter to four meters above the ground to determine the maximum value of the field strength. Both horizontal and vertical polarizations of the antenna are set to make the measurement.
d.For each suspected emission, the EUT was arranged to its worst case and then the antenna was tuned to heights from 1 meter to 4 meters (for the test frequency of below 30MHz, the antenna was tuned to heights 1 meter) and the rota table table was turned from 0 degrees to 360 degrees to find the maximum reading.
e.The test-receiver system was set to Peak Detect Function and Specified Bandwidth with Maximum Hold Mode.
f.If the emission level of the EUT in peak mode was 10dB lower than the limit specified, then testing could be stopped and the peak values of the EUT would be reported. Otherwise the emissions that did not have 10dB margin would be re-tested one by one using peak, quasi-peak or average method as specified and then reported in a data sheet.
Above 1GHz test procedure as below:
g.Different between above is the test site, change from Semi- Anechoic Chamber to fully Anechoic Chamber and change form table 0.8 meter to 1.5 meter(Above 18GHz the distance is 1 meter and table is 1.5 meter).
h.Test the EUT in the lowest channel ,the middle channel ,the Highest channel
j.Repeat above procedures until all frequencies measured was complete.

Receiver set:

Frequency	Detector	RBW	VBW	Remark
0.009MHz-0.090MHz	Peak	10kHz	30KHz	Peak
0.009MHz-0.090MHz	Average	10kHz	30KHz	Average
0.090MHz-0.110MHz	Quasi-peak	10kHz	30KHz	Quasi-peak
0.110MHz-0.490MHz	Peak	10kHz	30KHz	Peak
0.110MHz-0.490MHz	Average	10kHz	30KHz	Average
0.490MHz -30MHz	Quasi-peak	10kHz	30kHz	Quasi-peak
30MHz-1GHz	Quasi-peak	120 kHz	300KHz	Quasi-peak
Above 1GHz	Peak	1MHz	3MHz	Peak
	Peak	1MHz	10Hz	Average

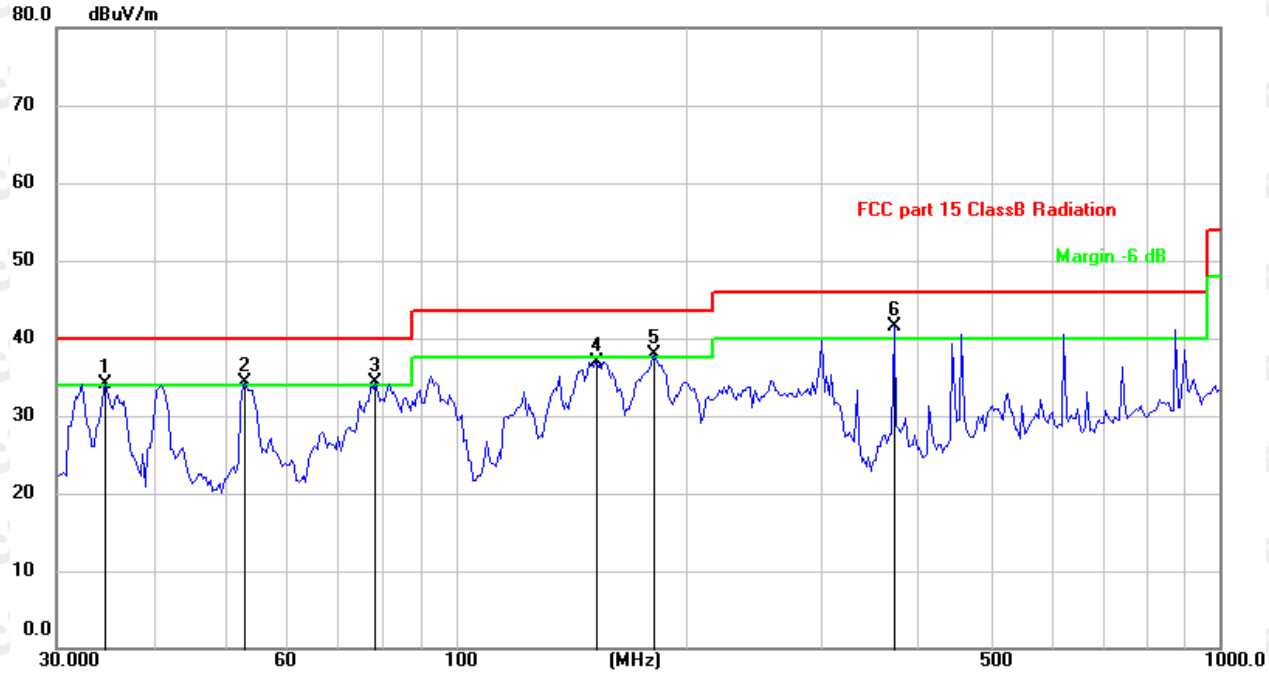
7.4 Test Result

30MHz-1GHzTest Results: (the worst data)
Antenna polarity: H



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1		32.4059	40.32	-7.18	33.14	40.00	-6.86	peak
2	*	41.7129	40.20	-5.77	34.43	40.00	-5.57	peak
3		52.9453	35.84	-6.31	29.53	40.00	-10.47	peak
4		79.5209	44.24	-10.35	33.89	40.00	-6.11	peak
5		152.6641	43.62	-6.30	37.32	43.50	-6.18	peak
6		374.6225	43.01	-3.16	39.85	46.00	-6.15	peak

Antenna polarity: V



No.	Mk.	Freq.	Reading Level	Correct Factor	Measure-ment	Limit	Margin	
		MHz	dBuV	dB	dBuV/m	dBuV/m	dB	Detector
1	!	34.7601	40.88	-6.74	34.14	40.00	-5.86	peak
2	!	52.9453	40.64	-6.31	34.33	40.00	-5.67	peak
3	!	78.4133	44.55	-10.16	34.39	40.00	-5.61	peak
4		152.6641	43.30	-6.30	37.00	43.50	-6.50	peak
5	!	181.9202	46.30	-8.47	37.83	43.50	-5.67	peak
6	*	374.6225	44.75	-3.16	41.59	46.00	-4.41	peak

Remark: Factor = Cable lose + Antenna factor - Pre-amplifier; Margin = Measurement – Limit

1. The margin of 9K-30MH measurement exceeds 20dB, so the test chart is not included. Test Mode: TM1 (the worst)
2. After pre-scanning three directions, the report recorded the worst case Test Mode: TM1 (the worst)

Radiated Spurious Emission (Above 1GHz):

Modulation : 802.11(a) (the worst data)

Freq (MHz)	Rd_level (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	detector	Height	Degree	Antenna polarization
Channel:5180MHz									
10360	43.75	16.39	60.14	74	-13.86	PK	1.87	359	H
10360	29.27	16.39	45.66	54	-8.34	AV	1.82	216	H
10360	45.18	16.39	61.57	74	-12.43	PK	1.53	117	V
10360	28.83	16.39	45.22	54	-8.78	AV	1.75	229	V
Channel:5240MHz									
10480	44.46	16.11	60.57	74	-13.43	PK	1.55	144	H
10480	28.84	16.11	44.95	54	-9.05	AV	1.59	277	H
10480	44.89	16.11	61.00	74	-13.00	PK	1.02	110	V
10480	28.78	16.11	44.89	54	-9.11	AV	1.30	218	V
Channel:5745MHz									
11490	42.01	17.46	59.47	74	-14.53	PK	1.43	145	H
11490	27.16	17.46	44.62	54	-9.38	AV	1.32	190	H
11490	44.72	17.46	62.18	74	-11.82	PK	1.11	195	V
11490	29.46	17.46	46.92	54	-7.08	AV	1.51	186	V
Channel:5825MHz									
11650	40.31	17.57	57.88	74	-16.12	PK	1.35	313	H
11650	29.67	17.57	47.24	54	-6.76	AV	1.54	172	H
11650	44.46	17.57	62.03	74	-11.97	PK	1.32	273	V
11650	26.79	17.57	44.36	54	-9.64	AV	1.56	325	V

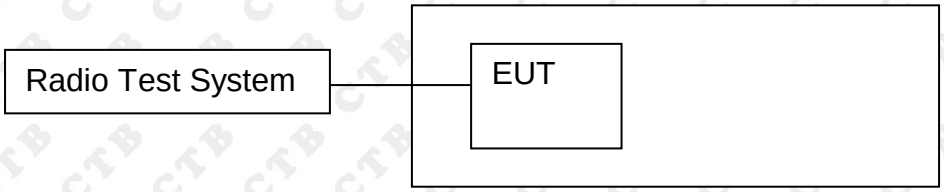
Modulation : 802.11(n40) (the worst data)

Freq (MHz)	Rd_level (dBuV/m)	Factor (dB)	Level (dBuV/m)	Limit (dBuV/m)	Over (dB)	detector	Height	Degree	Antenna polarization
Channel:5190MHz									
10380	40.20	16.34	56.54	74	-17.46	PK	1.53	104	H
10380	27.20	16.34	43.54	54	-10.46	AV	1.61	190	H
10380	40.78	16.34	57.12	74	-16.88	PK	1.16	182	V
10380	26.43	16.34	42.77	54	-11.23	AV	1.35	147	V
Channel:5230MHz									
10460	39.44	16.15	55.59	74	-18.41	PK	1.54	329	H
10460	24.87	16.15	41.02	54	-12.98	AV	1.12	141	H
10460	40.86	16.15	57.01	74	-16.99	PK	1.07	206	V
10460	27.38	16.15	43.53	54	-10.47	AV	1.26	191	V
Channel:5755MHz									
11510	40.55	17.49	58.04	74	-15.96	PK	1.74	295	H
11510	26.01	17.49	43.50	54	-10.50	AV	1.17	203	H
11510	42.46	17.49	59.95	74	-14.05	PK	1.18	183	V
11510	28.81	17.49	46.30	54	-7.70	AV	1.70	157	V
Channel:5795MHz									
11590	43.24	17.52	60.76	74	-13.24	PK	1.53	111	H
11590	25.14	17.52	42.66	54	-11.34	AV	1.63	194	H
11590	40.84	17.52	58.36	74	-15.64	PK	1.44	338	V
11590	26.30	17.52	43.82	54	-10.18	AV	1.06	275	V

Remark:
1.Factor = Antenna Factor + Cable Loss – Pre-amplifier. Emission level = Reading Result + Factor, Margin = Emission level - Limits
2.The EUT was tested in the low, high channel and the worst case position data was reported.
3.Testing is carried out with frequency rang 9kHz to the tenth harmonics, other than listed in the table above are attenuated more than 20dB below the permissible limits or the field strength is too small to be measured.

8. BAND EDGE

8.1 Block Diagram Of Test Setup



8.2 Limit

(1) For transmitters operating in the 5.15-5.25 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(2) For transmitters operating in the 5.25-5.35 GHz band: All emissions outside of the 5.15-5.35 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(3) For transmitters operating in the 5.47-5.725 GHz band: All emissions outside of the 5.47-5.725 GHz band shall not exceed an e.i.r.p. of −27 dBm/MHz.
(4) For transmitters operating in the 5.725-5.85 GHz band: All emissions within the frequency range from the band edge to 10 MHz above or below the band edge shall not exceed an e.i.r.p. of −17 dBm/MHz; for frequencies 10 MHz or greater above or below the band edge, emissions shall not exceed an e.i.r.p. of −27 dBm/MHz.
(5) The emission measurements shall be performed using a minimum resolution bandwidth of 1 MHz. A lower resolution bandwidth may be employed near the band edge, when necessary, provided the measured energy is integrated to show the total power over 1 MHz.
(6) Unwanted emissions below 1 GHz must comply with the general field strength limits set forth in §15.209. Further, any U-NII devices using an AC power line are required to comply also with the conducted limits set forth in §15.207.

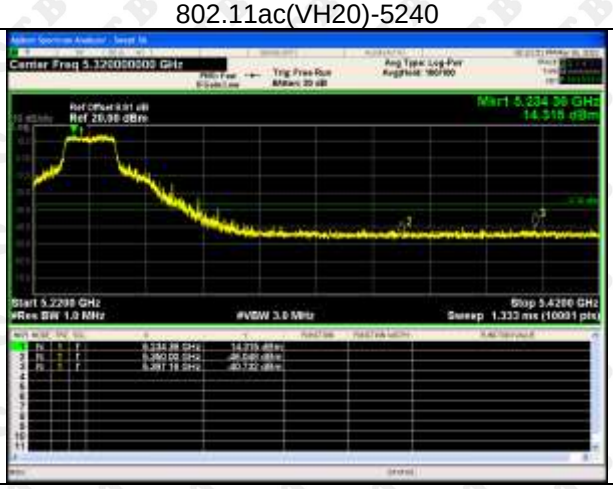
8.3 Test procedure

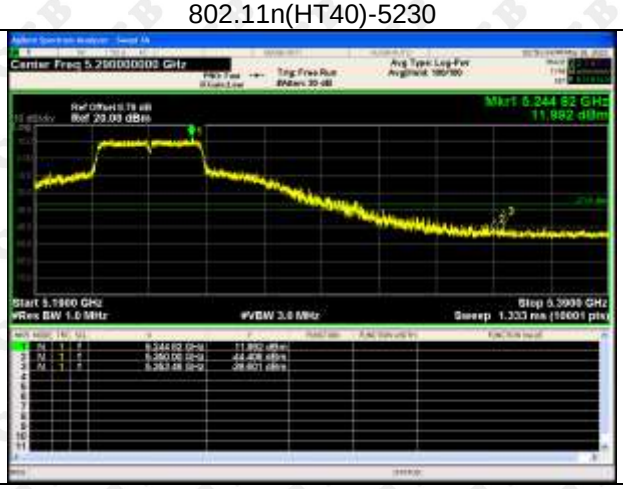
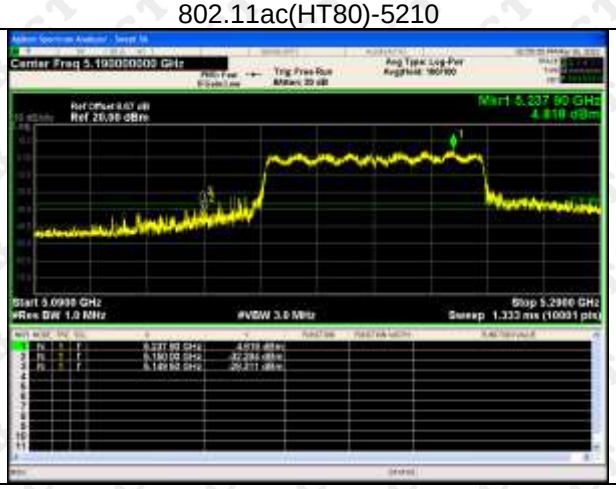
1. Check the calibration of the measuring instrument using either an internal calibrator or a known signal from an external generator.
2. Position the EUT without connection to measurement instrument. Turn on the EUT and connect its antenna terminal to measurement instrument via a low loss cable. Then set it to any one measured frequency within its operating range, and make sure the instrument is operated in its linear range.
3. Set RBW of spectrum analyzer to 1 MHz with a convenient frequency span.
4. Measure the highest amplitude appearing on spectral display and set it as a reference level. Plot the graph with marking the highest point and edge frequency.
5. Repeat above procedures until all measured frequencies were complete.

8.4 Test Result

Test Graph

5180-5240MHz

802.11a-5180	802.11a-5240
802.11ac(VH20)-5180	802.11ac(VH20)-5240
	
802.11ac(VH40)-5190	802.11ac(VH40)-5230

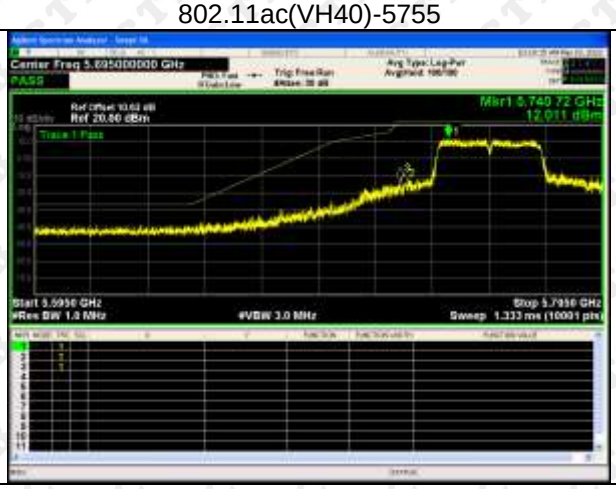
802.11n(HT20)-5180	802.11n(HT20)-5240
802.11n(HT40)-5190	802.11n(HT40)-5230
	
802.11ac(HT80)-5210	
	

5745-5825MHz

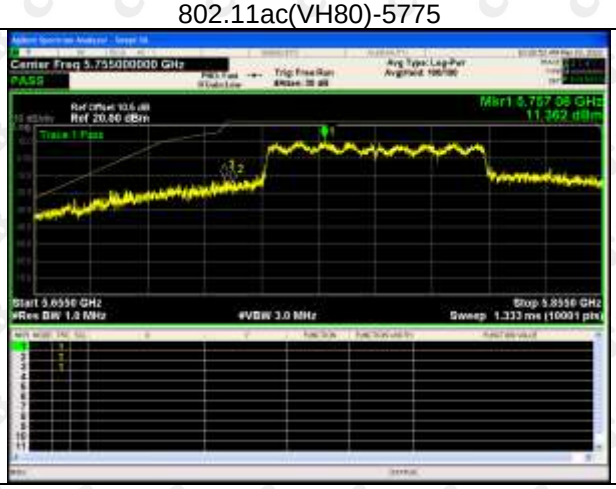
802.11a-5745	802.11a-5825
802.11(n20)-5745	802.11(n20)-5825
802.11(n40)-5755	802.11(n40)-5795
802.11ac(VH20)-5745	802.11ac(VH20)-5825

802.11ac(VH40)-5755

802.11ac(VH40)-5795

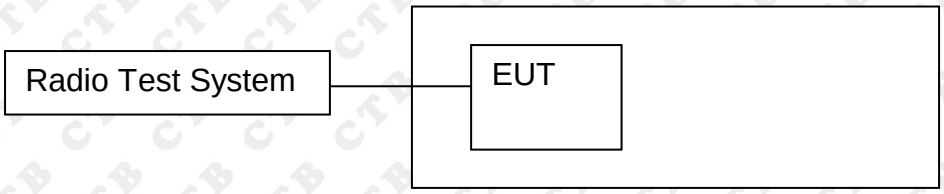


802.11ac(VH80)-5775



9. CONDUCTED PEAK OUTPUT POWER

9.1 Block Diagram Of Test Setup



9.2 Limit

(1) For the band 5.15-5.25 GHz.
(i) For an outdoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. The maximum e.i.r.p.
at any elevation angle above 30 degrees as measured from the horizon must not exceed 125 mW (21 dBm).
(ii) For an indoor access point operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W provided the maximum antenna gain does not exceed 6 dBi. In addition,the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(iii) For fixed point-to-point access points operating in the band 5.15-5.25 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 17 dBm in any 1 megahertz band. Fixed point-to-point U-NII devices may employ antennas with directional gain up to 23 dBi without any corresponding reduction in the maximum conducted output power or maximum power spectral density. For fixed point-to-point transmitters that employ a directional antenna gain greater than 23 dBi, a 1 dB reduction in maximum conducted output power and maximum power spectral density is required for each 1 dB of antenna gain in excess of 23 dBi. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(4) The maximum conducted output power must be measured over any interval of continuous transmission using instrumentation calibrated in terms of an rms-equivalent voltage.
(5) The maximum power spectral density is measured as a conducted emission by direct connection of a calibrated test instrument to the equipment under test. If the device cannot be connected directly, alternative techniques acceptable to the Commission may be used. Measurements in the 5.725-5.85 GHz band are made over a reference bandwidth of 500 kHz or the 26 dB emission bandwidth of the device, whichever is less. Measurements in the 5.15-5.25 GHz, 5.25-5.35 GHz, and the 5.47-5.725 GHz bands are made over a bandwidth of 1 MHz or the 26 dB emission bandwidth of the device, whichever is less. A narrower resolution

bandwidth can be used, provided that the measured power is integrated over the full reference bandwidth.

(h) Transmit Power Control (TPC) and Dynamic Frequency Selection (DFS).
(1) Transmit power control (TPC). U-NII devices operating in the 5.25-5.35 GHz band and the 5.47-5.725 GHz band shall employ a TPC mechanism. The U-NII device is required to have the capability to operate at least 6 dB below the mean EIRP value of 30 dBm. A TPC mechanism is not required for systems with an e.i.r.p. of less than 500 mW.

9.3 Test procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

(i) Set span to encompass the entire emission bandwidth (EBW) (or, alternatively, the entire 99% occupied bandwidth) of the signal.

(ii) Set RBW = 1 MHz.

(iii) Set VBW ≥ 3 MHz.

(iv) Number of points in sweep ≥ 2 × span / RBW. (This ensures that bin-to-bin spacing is ≤ RBW/2, so that narrowband signals are not lost between frequency bins.)

(v) Sweep time = auto.

(vi) Detector = power averaging (rms), if available. Otherwise, use sample detector mode.

(vii) If transmit duty cycle < 98%, use a video trigger with the trigger level set to enable triggering only on full power pulses. Transmitter must operate at maximum power control level for the entire duration of every sweep. If the EUT transmits continuously (i.e., with no off intervals) or at duty cycle ≥ 98%, and if each transmission is entirely at the maximum power control level, then the trigger shall be set to "free run."

(viii) Trace average at least 100 traces in power averaging (rms) mode.

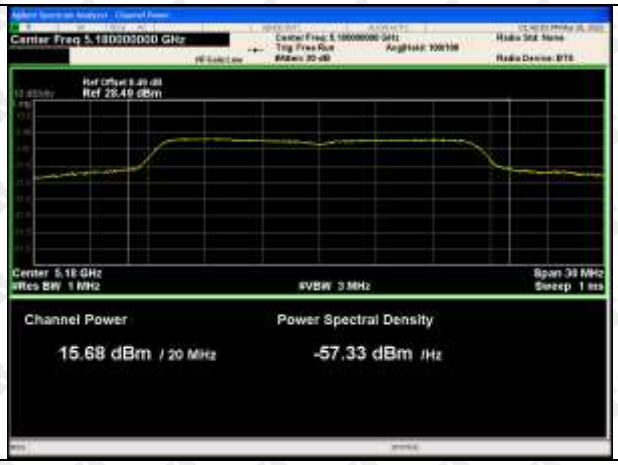
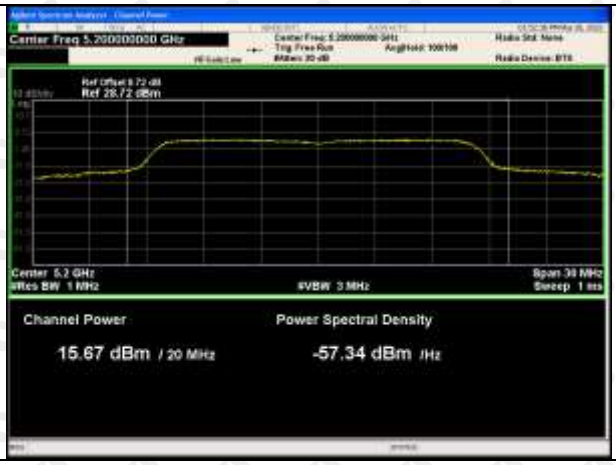
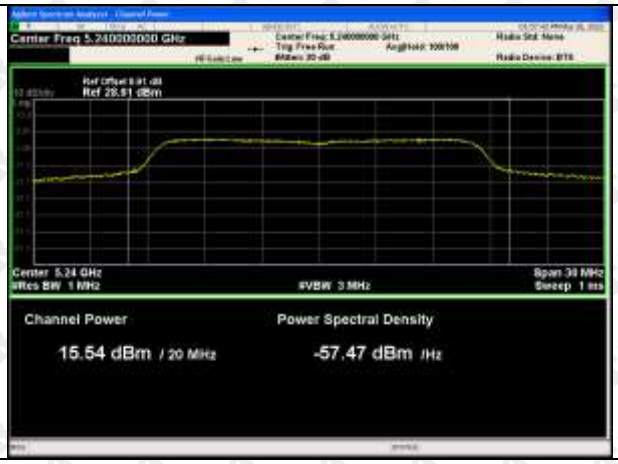
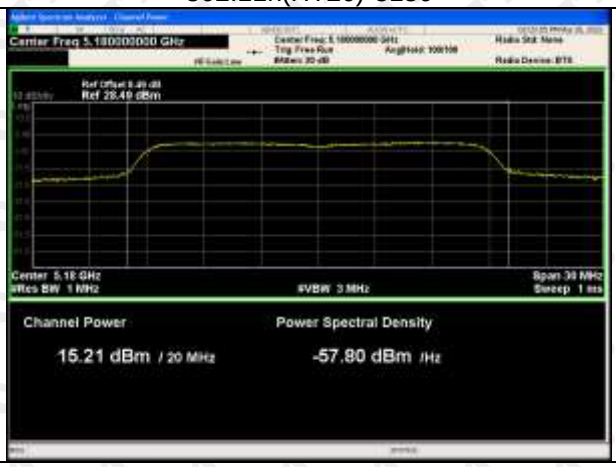
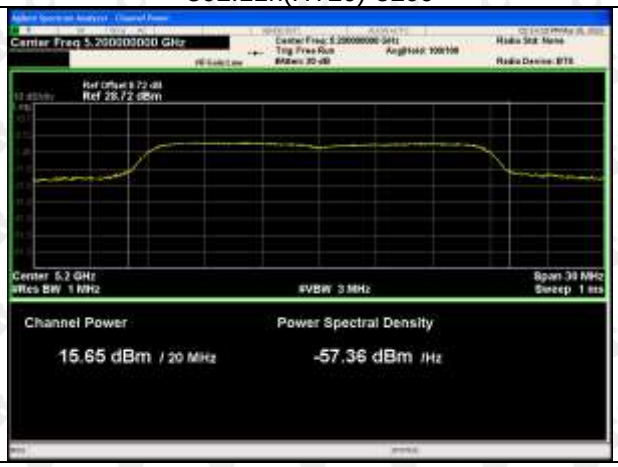
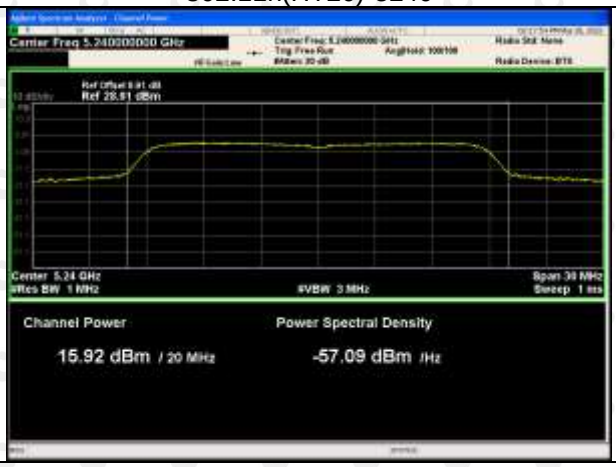
(ix) Compute power by integrating the spectrum across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the signal using the instrument's band power measurement function with band limits set equal to the EBW (or occupied bandwidth) band edges. If the instrument does not have a band power function, sum the spectrum levels (in power units) at 1 MHz intervals extending across the EBW (or, alternatively, the entire 99% occupied bandwidth) of the spectrum.

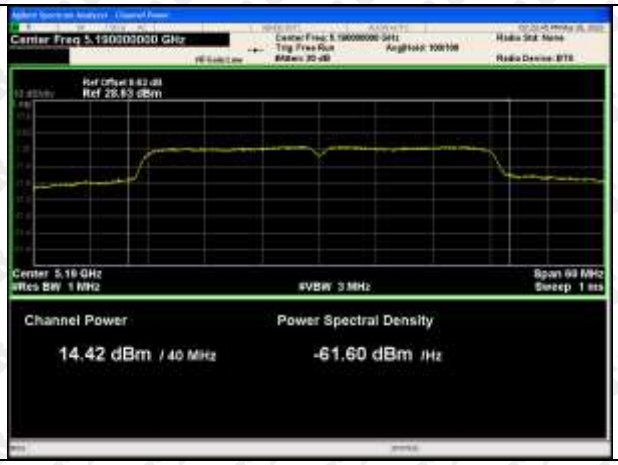
9.4 Test Result

Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a20	5180	15.676	23.98
	5200	15.673	23.98
	5240	15.543	23.98
802.11ac20	5180	15.308	23.98
	5200	15.259	23.98
	5240	15.699	23.98
802.11ac40	5190	14.218	23.98
	5230	14.571	23.98
802.11ac80	5210	13.491	23.98
802.11n(HT20)	5180	15.213	23.98
	5200	15.65	23.98
	5240	15.919	23.98
802.11n(HT40)	5190	14.417	23.98
	5230	14.744	23.98

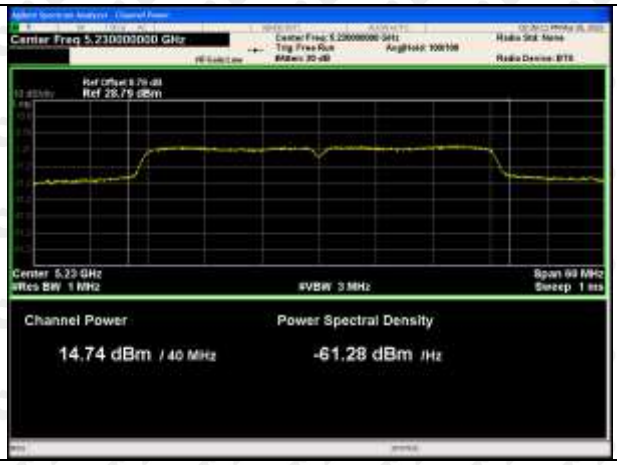
Test mode1	Test Channel (MHz)	Output Power dBm	Limit dBm
802.11a20	5745	15.073	30
	5785	15.141	30
	5825	14.998	30
802.11ac20	5745	15.418	30
	5785	15.426	30
	5825	15.216	30
802.11ac40	5755	14.771	30
	5795	14.099	30
802.11ac80	5775	13.344	30
802.11n(HT20)	5745	15.16	30
	5785	15.472	30
	5825	15.22	30
802.11n(HT40)	5755	14.181	30
	5795	14.503	30

5180-5240MHz

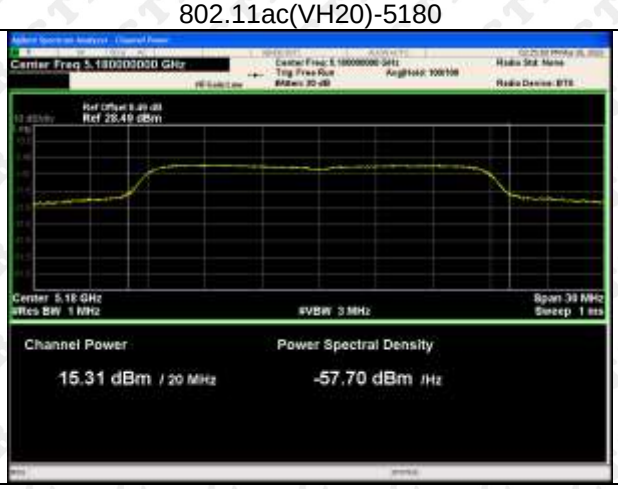
802.11a-5180	802.11a-5200
	
802.11a-5240	802.11n(HT20)-5180
	
802.11n(HT20)-5200	802.11n(HT20)-5240
	
802.11n(HT40)-5190	802.11n(HT40)-5230



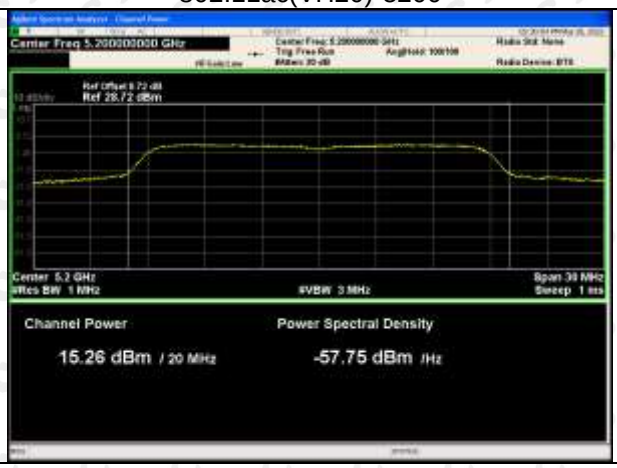
802.11ac(VH20)-5180



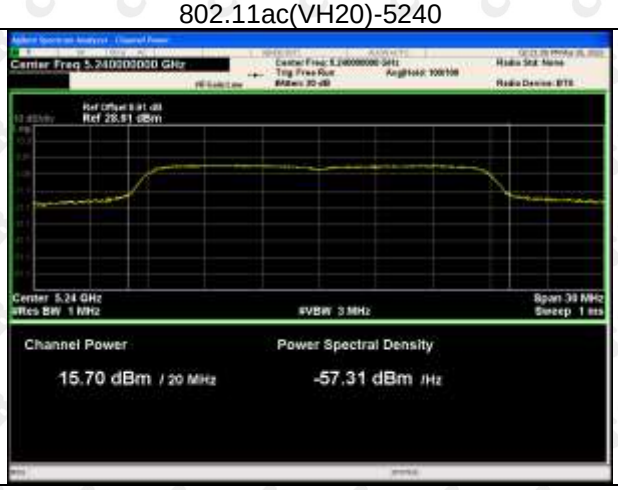
802.11ac(VH20)-5200



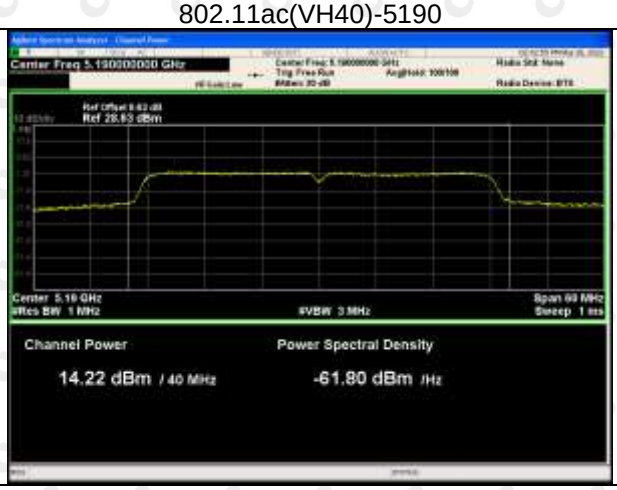
802.11ac(VH20)-5240



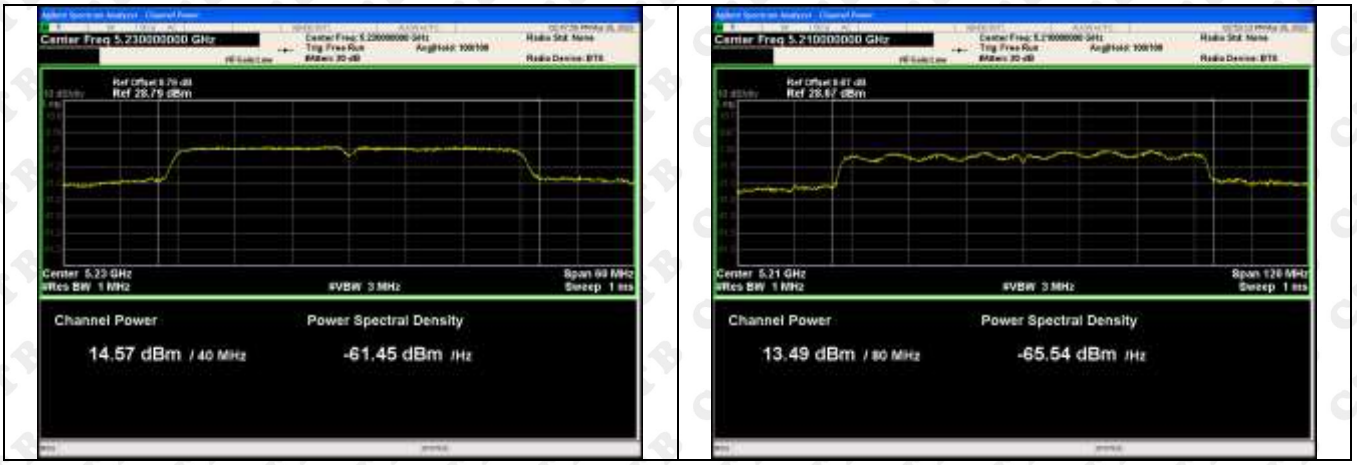
802.11ac(VH40)-5190



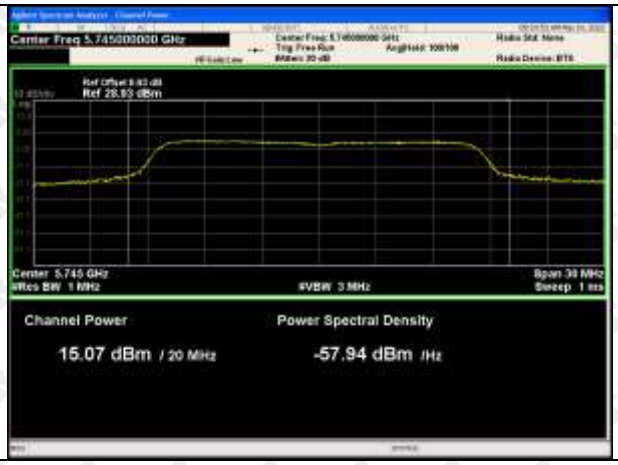
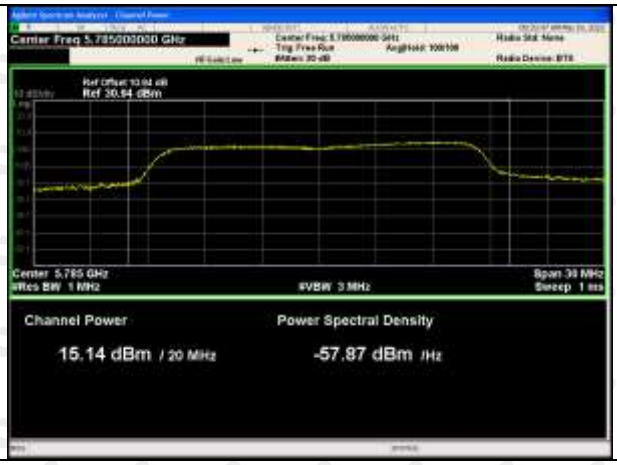
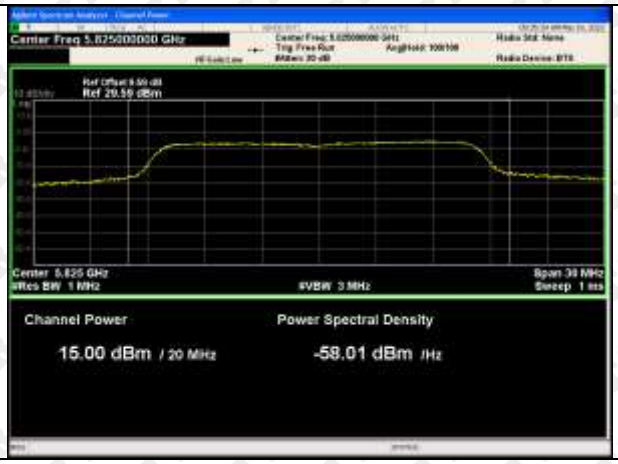
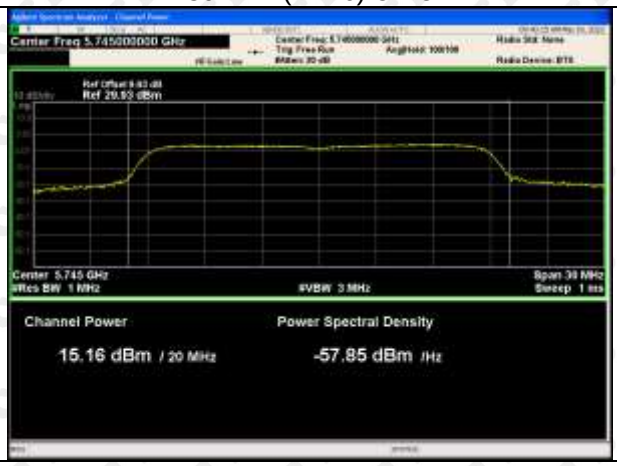
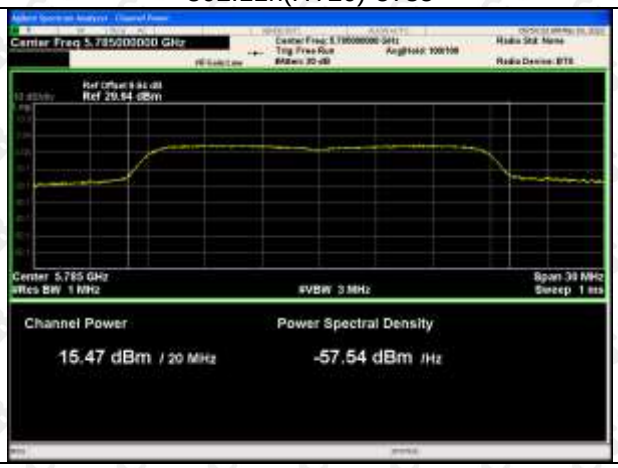
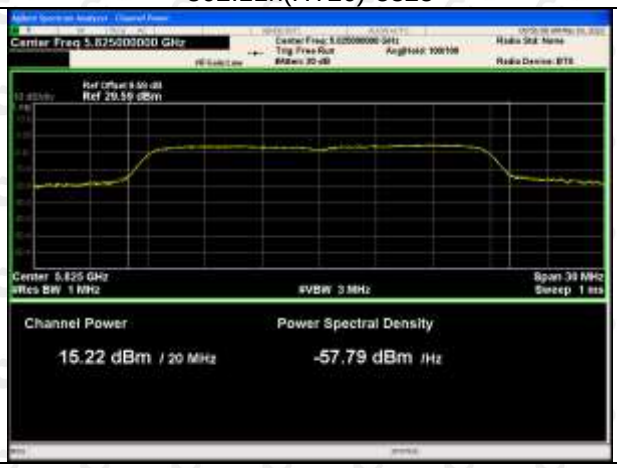
802.11ac(VH40)-5230

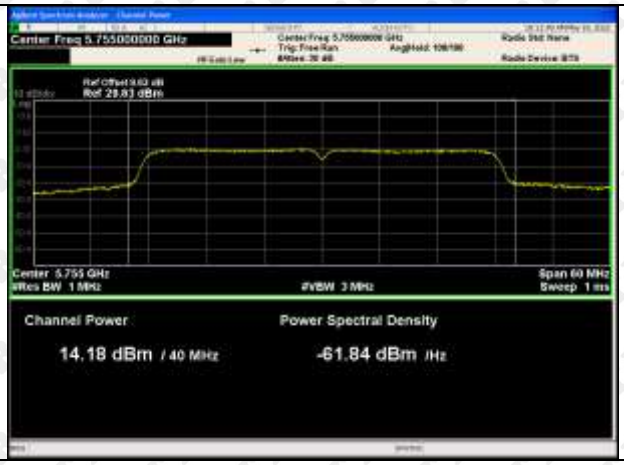


802.11ac(VH80)-5210

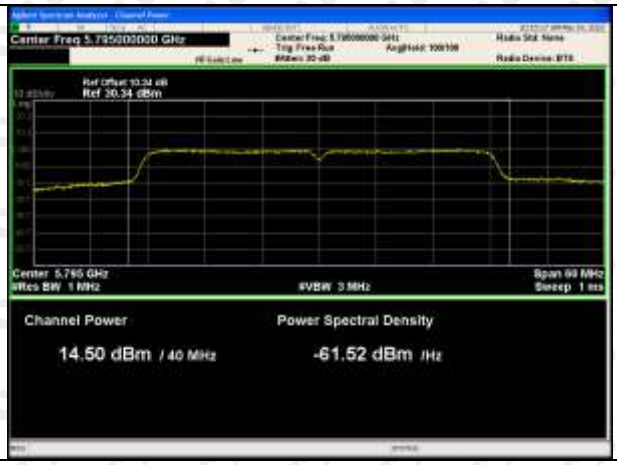

Center Freq 5.230000000 GHz
Ref 28.79 dBm
Center 5.23 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Channel Power
14.57 dBm / 40 MHz
Power Spectral Density
-61.45 dBm /Hz
Center Freq 5.210000000 GHz
Ref 28.67 dBm
Center 5.21 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Channel Power
13.49 dBm / 80 MHz
Power Spectral Density
-65.54 dBm /Hz

5745-5825MHz

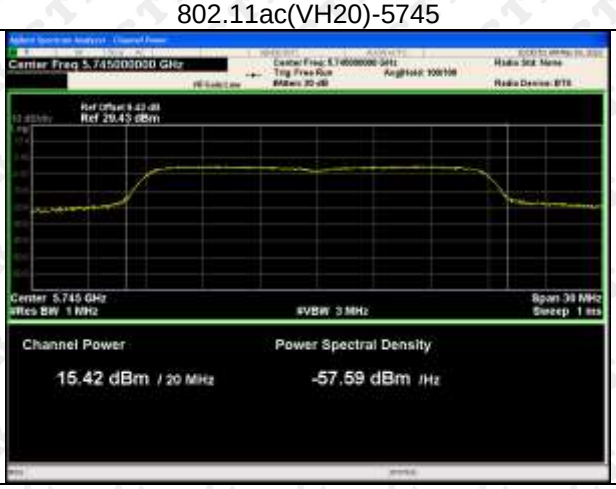
802.11a-5745	802.11a-5785
	
802.11a-5825	802.11n(HT20)-5745
	
802.11n(HT20)-5785	802.11n(HT20)-5825
	
802.11n(HT40)-5755	802.11n(HT40)-5795



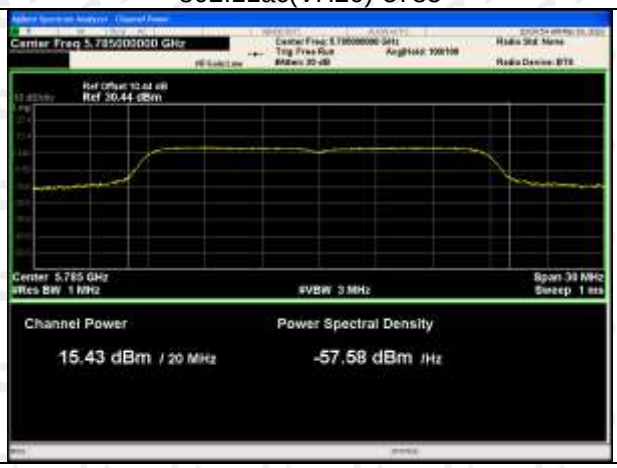
802.11ac(VH20)-5745



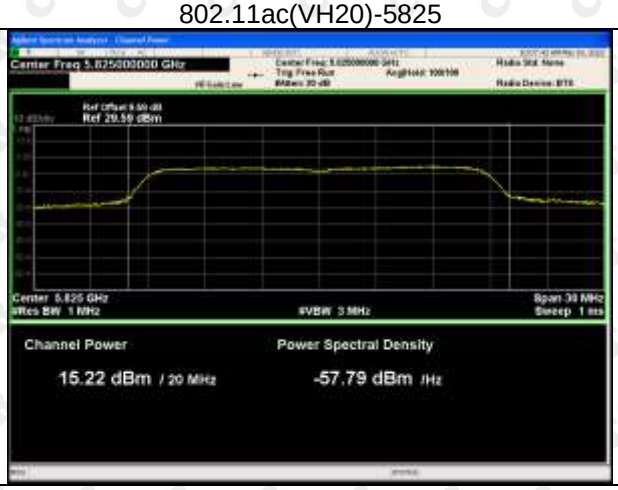
802.11ac(VH20)-5785



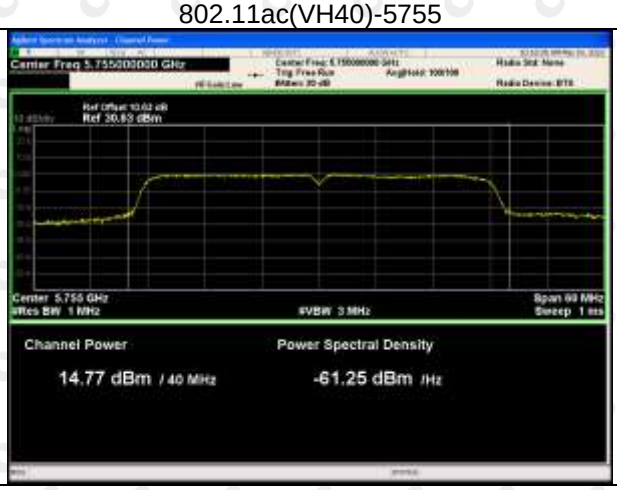
802.11ac(VH20)-5825



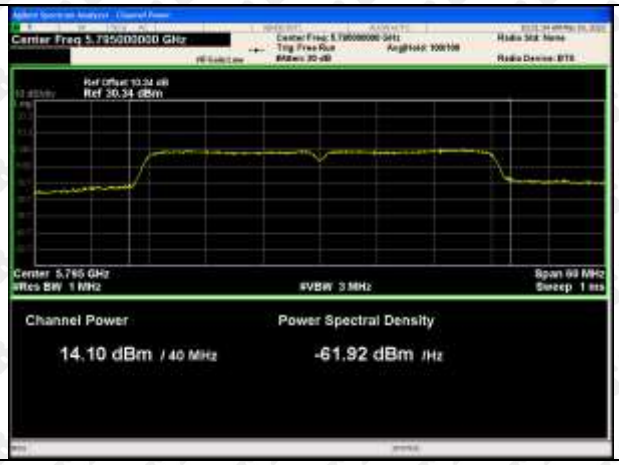
802.11ac(VH40)-5755

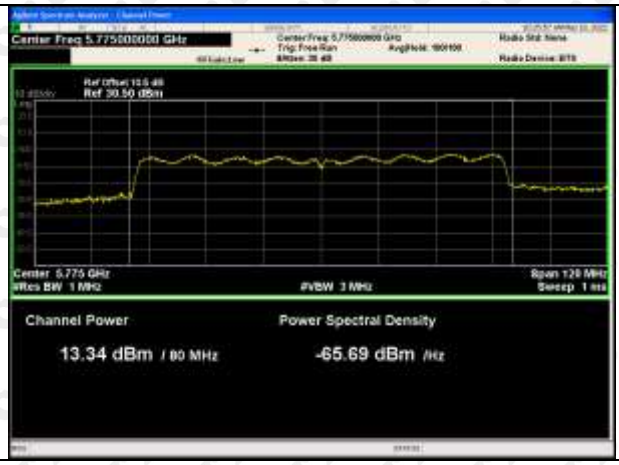


802.11ac(VH40)-5795



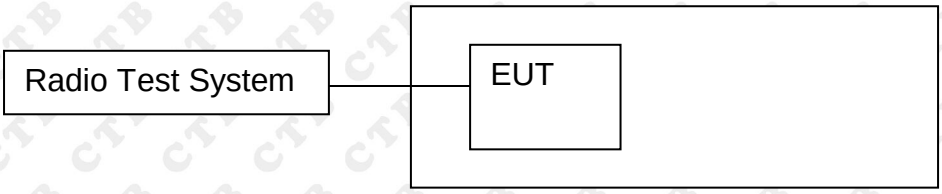
802.11ac(VH80)-5775


Center Freq 5.785000000 GHz
Ref 30.34 dBm
Center 5.785 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 60 MHz
Sweep 1 ms
Channel Power
14.10 dBm / 40 MHz
Power Spectral Density
-61.92 dBm /Hz


Center Freq 5.775000000 GHz
Ref 30.50 dBm
Center 5.775 GHz
#Res BW 1 MHz
#VBW 3 MHz
Span 120 MHz
Sweep 1 ms
Channel Power
13.34 dBm / 80 MHz
Power Spectral Density
-65.69 dBm /Hz

10. EMISSION BANDWIDTH& OCCUPIED BANDWIDTH

10.1 Block Diagram Of Test Setup



10.2 Limits

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.
(e) Within the 5.725-5.85 GHz band, the minimum 6 dB bandwidth of U-NII devices shall be at least 500 kHz.

10.3 Test Procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

1. Emission Bandwidth (EBW)
a) Set RBW = approximately 1% of the emission bandwidth.
b) Set the VBW > RBW.
c) Detector = Peak.
d) Trace mode = max hold.
e) Measure the maximum width of the emission that is 26 dB down from the maximum of the emission. Compare this with the RBW setting of the analyzer. Readjust RBW and repeat measurement as needed until the RBW/EBW ratio is approximately 1%.
2. Minimum Emission Bandwidth for the band 5.725−5.85 GHz
Section 15.407(e) specifies the minimum 6 dB emission bandwidth of at least 500 kHz for the band 5.725−5.85 GHz. The following procedure shall be used for measuring this bandwidth:
a) Set RBW = 100 kHz.
b) Set the video bandwidth (VBW) ≥ 3 * RBW.
c) Detector = Peak.

d) Trace mode = max hold.
e) Sweep = auto couple.
f) Allow the trace to stabilize.
g) Measure the maximum width of the emission that is constrained by the frequencies associated with the two outermost amplitude points (upper and lower frequencies) that are attenuated by 6 dB relative to the maximum level measured in the fundamental emission.
Note: The automatic bandwidth measurement capability of a spectrum analyzer or EMI receiver may be employed if it implements the functionality described in this section. For devices that use channel aggregation refer to III.A and III.C for determining emission bandwidth.

D. 99% Occupied Bandwidth

The 99% occupied bandwidth is the frequency bandwidth such that, below its lower and above its upper frequency limits, the mean powers are each equal to 0.5% of the total mean power of the given emission. Measurement of the 99% occupied bandwidth is *required* only as a condition for using the optional band-edge measurement techniques described in II.G.3.d). Measurements of 99% occupied bandwidth may also optionally be used in lieu of the EBW to define the minimum frequency range over which the 789033 D02 General UNII Test Procedures New Rules v02r01 Page 4 spectrum is integrated when measuring maximum conducted output power as described in II.E. However, the EBW must be measured to determine bandwidth dependent limits on maximum conducted output power in accordance with Section 15.407(a).
The following procedure shall be used for measuring (99%) power bandwidth:
1. Set center frequency to the nominal EUT channel center frequency.

2. Set span = 1.5 times to 5.0 times the OBW.

3. Set RBW = 1% to 5% of the OBW

4. Set VBW ≥ 3 * RBW

5. Video averaging is not permitted. Where practical, a sample detection and single sweep mode shall be used. Otherwise, peak detection and max hold mode (until the trace stabilizes) shall be used.

6. Use the 99% power bandwidth function of the instrument (if available).

7. If the instrument does not have a 99% power bandwidth function, the trace data points are recovered and directly summed in power units. The recovered amplitude data points, beginning at the lowest frequency, are placed in a running sum until 0.5% of the total is reached; that frequency is recorded as the lower frequency. The process is repeated until 99.5% of the total is reached; that frequency is recorded as the upper frequency. The 99% occupied bandwidth is the difference between these two frequencies.

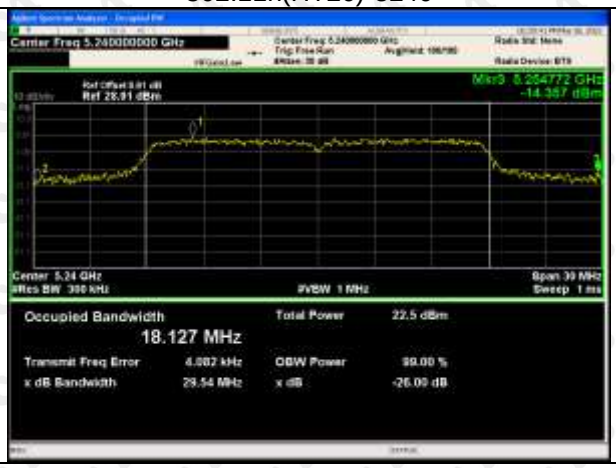
10.4 Test Results

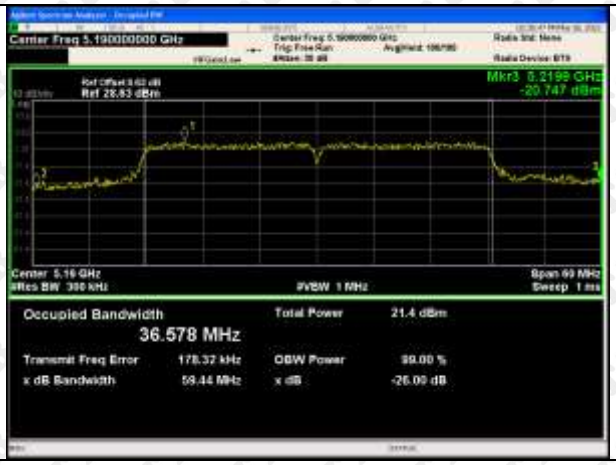
Test mode	Test Channel (MHz)	26dB Bandwidth (MHz)
802.11a	5180	29.132
	5200	30
	5240	23.422
802.11ac20	5180	29.316
	5200	29.504
	5240	29.512
802.11ac40	5190	58.761
	5230	56.23
802.11ac80	5210	108.973
802.11n(HT20)	5180	28.601
	5200	29.547
	5240	29.536
802.11n(HT40)	5190	59.444
	5230	53.894

Test mode	Test Channel (MHz)	6dB Bandwidth (MHz)
802.11a	5745	16.365
	5785	16.391
	5825	16.313
802.11a20	5745	17.028
	5785	17.172
	5825	16.923
802.11ac40	5755	35.701
	5795	35.726
802.11ac80	5775	74.442
802.11n(HT20)	5745	16.795
	5785	16.811
	5825	16.858
802.11n(HT40)	5755	35.532
	5795	35.262

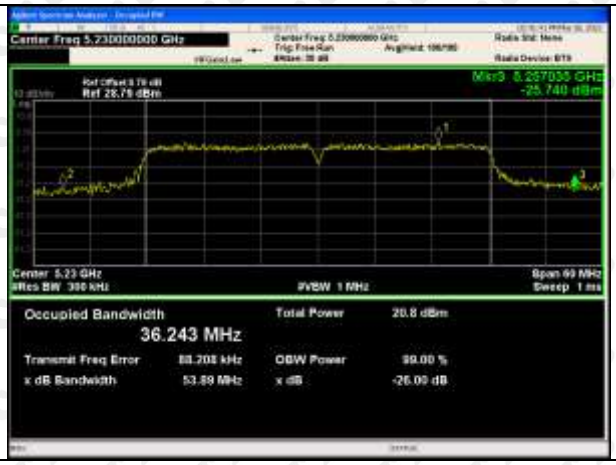
Test Graph

5180-5240MHz

802.11a-5180	802.11a-5200
802.11a-5240	802.11n(HT20)-5180
802.11n(HT20)-5200	802.11n(HT20)-5240
	
802.11n(HT40)-5190	802.11n(HT40)-5230



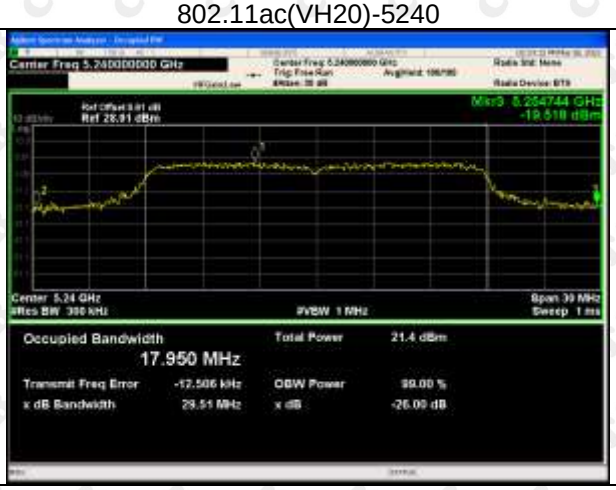
802.11ac(VH20)-5180



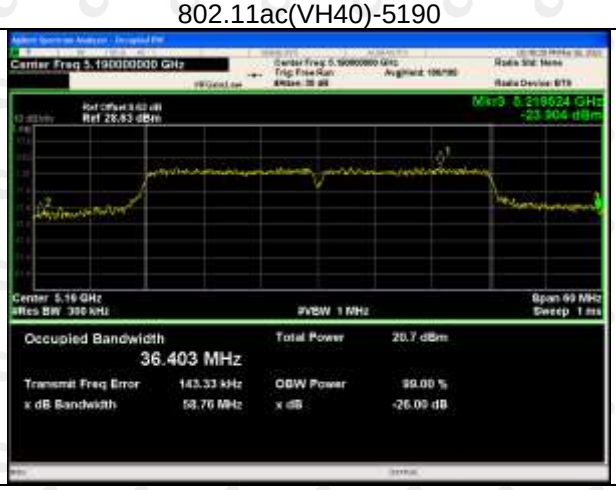
802.11ac(VH20)-5200

802.11ac(VH20)-5240

802.11ac(VH40)-5190



802.11ac(VH40)-5230



802.11ac(VH80)-5230

Center Freq 5.230000000 GHz
Ref 28.79 dBm
Center 5.23 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 69 MHz
Sweep 1 ms
Occupied Bandwidth
36.405 MHz
Total Power 21.1 dBm
Transmit Freq Error 135.00 kHz
OBW Power 99.00 %
x dB Bandwidth 56.23 MHz
x dB -26.00 dB
Center Freq 5.210000000 GHz
Ref 28.67 dBm
Center 5.21 GHz
#Res BW 300 kHz
#VBW 1 MHz
Span 120 MHz
Sweep 1.267 ms
Occupied Bandwidth
75.875 MHz
Total Power 21.3 dBm
Transmit Freq Error 270.44 kHz
OBW Power 99.00 %
x dB Bandwidth 109.0 MHz
x dB -26.00 dB

5745-5825MHz

802.11a-5745	802.11a-5785
802.11a-5825	802.11n(HT20)-5745
802.11n(HT20)-5785	802.11n(HT20)-5825
802.11n(HT40)-5755	802.11n(HT40)-5795

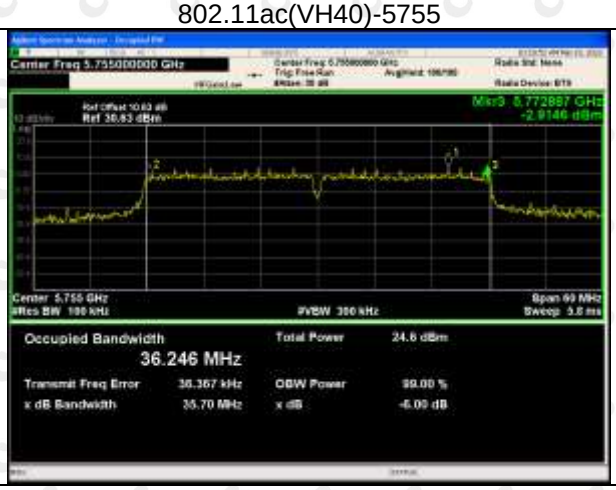
802.11ac(VH20)-5745

802.11ac(VH20)-5785

802.11ac(VH20)-5825

802.11ac(VH40)-5755

802.11ac(VH40)-5795



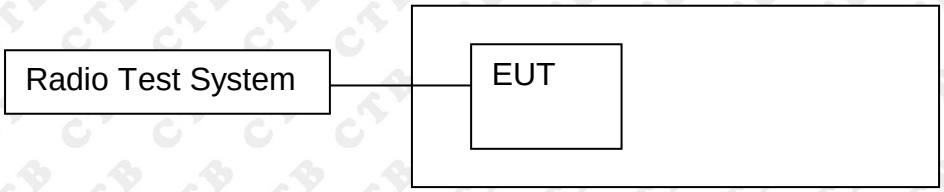
802.11ac(VH80)-5775

Center Freq 5.795000000 GHz
Ref Offset 10.34 dB
Ref 30.34 dBm
Mkr3 5.814306 GHz
-11.285 dBm
Center 5.795 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 60 MHz
Sweep 5.8 ms
Occupied Bandwidth
39.421 MHz
Total Power 24.1 dBm
Transmit Freq Error 1.4923 MHz
OBW Power 99.00 %
x dB Bandwidth 35.73 MHz
x dB -6.00 dB

Center Freq 5.775000000 GHz
Ref Offset 10.6 dB
Ref 30.60 dBm
Mkr3 5.815315 GHz
-20.223 dBm
Center 5.775 GHz
#Res BW 100 kHz
#VBW 300 kHz
Span 120 MHz
Sweep 11.53 ms
Occupied Bandwidth
82.020 MHz
Total Power 25.7 dBm
Transmit Freq Error 3.0943 MHz
OBW Power 99.00 %
x dB Bandwidth 74.44 MHz
x dB -6.00 dB

11. POWER SPECTRAL DENSITY

11.1 Block Diagram Of Test Setup



11.2 Limit

(1) For the band 5.15-5.25 GHz.

(iv) For mobile and portable client devices in the 5.15-5.25 GHz band, the maximum conducted output power over the frequency band of operation shall not exceed 250 mW provided the maximum antenna gain does not exceed 6 dBi. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.
(2) For the 5.25-5.35 GHz and 5.47-5.725 GHz bands, the maximum conducted output power over the frequency bands of operation shall not exceed the lesser of 250 mW or 11 dBm + 10 log B, where B is the 26 dB emission bandwidth in megahertz. In addition, the maximum power spectral density shall not exceed 11 dBm in any 1 megahertz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(3) For the band 5.725-5.85 GHz, the maximum conducted output power over the frequency band of operation shall not exceed 1 W. In addition, the maximum power spectral density shall not exceed 30 dBm in any 500-kHz band. If transmitting antennas of directional gain greater than 6 dBi are used, both the maximum conducted output power and the maximum power spectral density shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi. However, fixed point-to-point U-NII devices operating in this band may employ transmitting antennas with directional gain greater than 6 dBi without any corresponding reduction in transmitter conducted power. Fixed, point-to-point operations exclude the use of point-to-multipoint systems, omnidirectional applications, and multiple collocated transmitters transmitting the same information. The operator of the U-NII device, or if the equipment is professionally installed, the installer, is responsible for ensuring that systems employing high gain directional antennas are used exclusively for fixed, point-to-point operations.

11.3 Test procedure

According to KDB789033 D02v02r01 sectionE, the following is the measurement procedure.

For devices operating in the bands 5.15−5.25 GHz, 5.25−5.35 GHz, and 5.47−5.725 GHz, the preceding procedures make use of 1 MHz RBW to satisfy directly the 1 MHz reference bandwidth specified in Section 15.407(a)(5). For devices operating in the band 5.725−5.85 GHz, the rules specify a measurement bandwidth of 500 kHz. Many spectrum analyzers do not have 500 kHz RBW, thus a narrower RBW may need to be used. The rules permit the use of RBWs less than 1 MHz, or 500 kHz, “provided that the measured power is integrated over the full reference bandwidth” to show the total power over the specified measurement bandwidth (i.e., 1 MHz, or 500 kHz). If measurements are performed using a reduced resolution bandwidth (< 1 MHz, or < 500 kHz) and integrated over 1 MHz, or 500 kHz bandwidth, the following adjustments to the procedures apply:
a) Set RBW ≥ 1/*T*, where *T* is defined in II.B.l.a).

b) Set VBW ≥ 3 RBW.

c) If measurement bandwidth of Maximum PSD is specified in 500 kHz, add 10 log (500 kHz/RBW) to the measured result, whereas RBW (<500 kHz) is the reduced resolution bandwidth of the spectrum analyzer set during measurement.

d) If measurement bandwidth of Maximum PSD is specified in 1 MHz, add 10 log (1MHz/RBW) to the measured result, whereas RBW (< 1 MHz) is the reduced resolution bandwidth of spectrum analyzer set during measurement.

e) Care must be taken to ensure that the measurements are performed during a period of continuous transmission or are corrected upward for duty cycle.
Note: As a practical matter, it is recommended to use reduced RBW of 100 kHz for the II.F.5.c) and II.F.5.d), since RBW=100 kHz is available on nearly all spectrum analyzers.

11.4 Test Result

Test mode	Test Channel (MHz)	PSD [dBm/MHz]	Limit [dBm/MHz]	Result
802.11a	5180	10.474	11	Pass
	5200	10.872	11	Pass
	5240	10.449	11	Pass
802.11ac(VH20)	5180	9.691	11	Pass
	5200	10.492	11	Pass
	5240	10.597	11	Pass
802.11ac(VH40)	5190	8.294	11	Pass
	5230	9.646	11	Pass
802.11ac(VH80)	5210	4.695	11	Pass
802.11n(HT20)	5180	10.511	11	Pass
	5200	10.083	11	Pass
	5240	10.576	11	Pass
802.11n(HT40)	5190	7.603	11	Pass
	5230	10.09	11	Pass

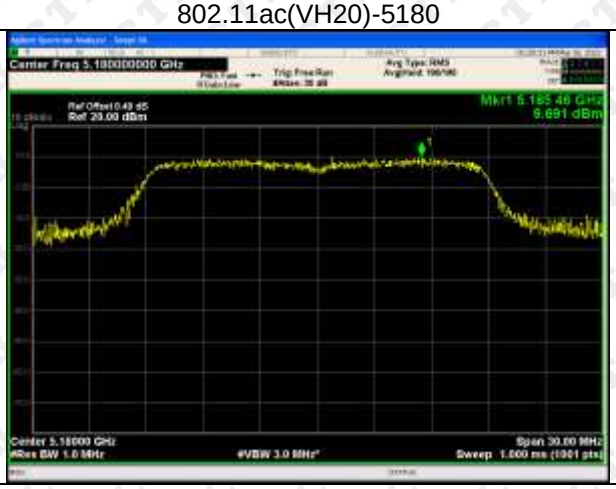
Test mode	Test Channel (MHz)	PSD [dBm/500kHz]	Result
802.11a	5745	9.319	Pass
	5785	9.605	Pass
	5825	9.285	Pass
802.11n(HT20)	5745	9.82	Pass
	5785	9.407	Pass
	5825	9.449	Pass
802.11n(HT40)	5755	7.43	Pass
	5795	7.763	Pass
802.11ac(VH20)	5745	5.703	Pass
	5785	10.499	Pass
	5825	9.189	Pass
802.11ac(VH40)	5755	9.667	Pass
	5795	7.146	Pass
802.11ac(VH80)	5775	7.253	Pass

5180-5230MHz

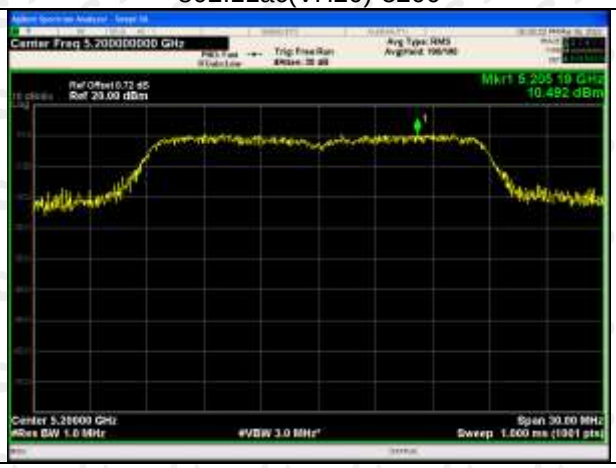
802.11a-5180	802.11a-5200
802.11a-5240	802.11n(HT20)-5180
802.11n(HT20)-5200	802.11n(HT20)-5240
802.11n(HT40)-5190	802.11n(HT40)-5230

802.11ac(VH20)-5180

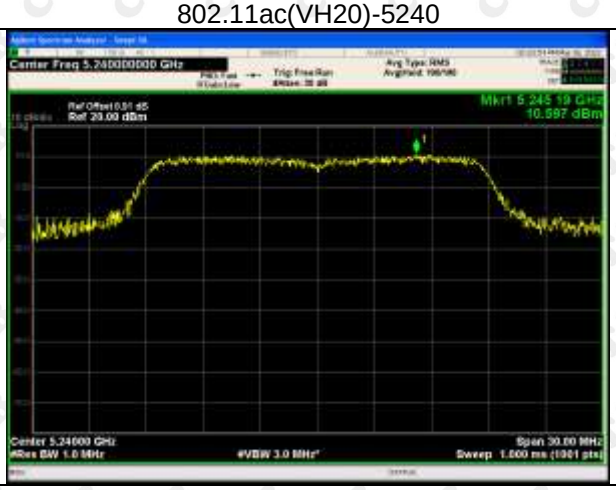
802.11ac(VH20)-5200



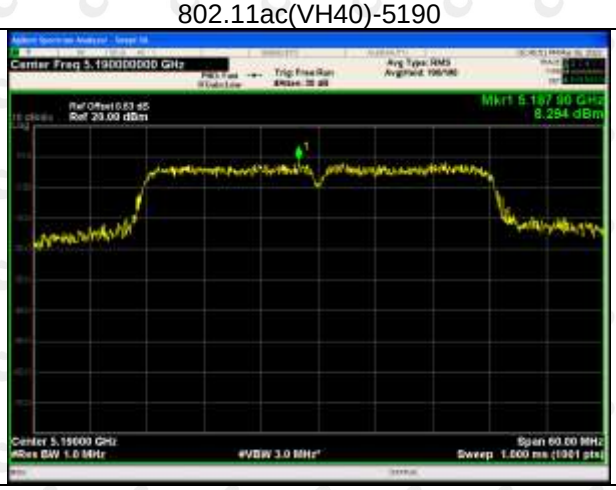
802.11ac(VH20)-5240



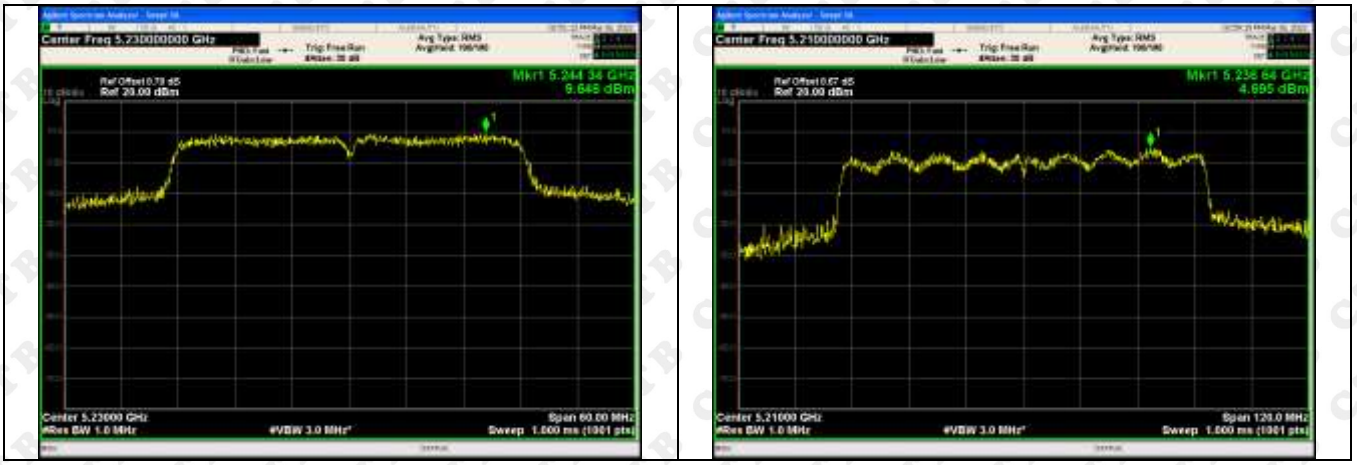
802.11ac(VH40)-5190



802.11ac(VH40)-5230



802.11ac(VH80)-5210

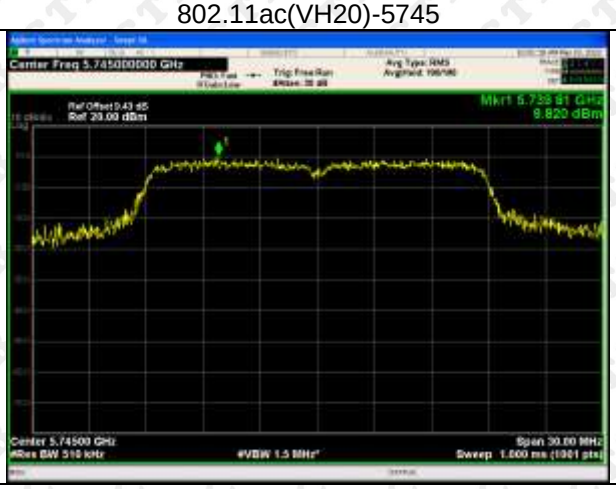

Center Freq 5.230000000 GHz
Mkr1 5.244 34 GHz
9.648 dBm
Center 5.23000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Span 60.00 MHz
Sweep 1.000 ms (1001 pts)
Center Freq 5.210000000 GHz
Mkr1 5.236 64 GHz
4.695 dBm
Center 5.21000 GHz
#Res BW 1.0 MHz
#VBW 3.0 MHz*
Span 120.0 MHz
Sweep 1.000 ms (1001 pts)

5745-5825MHz

802.11a-5745	802.11a-5785
802.11a-5825	802.11n(HT20)-5745
802.11n(HT20)-5785	802.11n(HT20)-5825
802.11n(HT40)-5755	802.11n(HT40)-5795

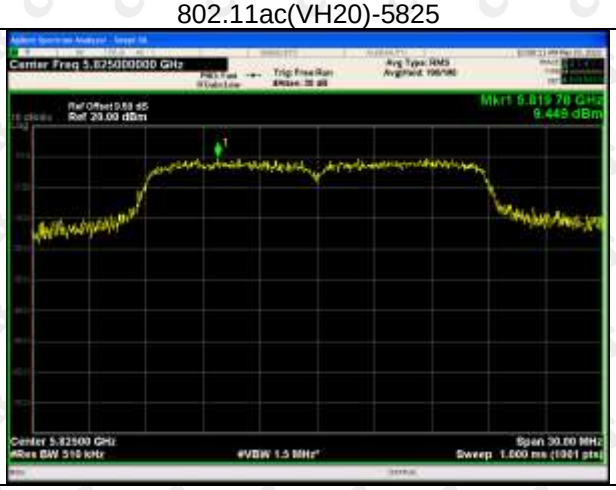
802.11ac(VH20)-5745

802.11ac(VH20)-5785

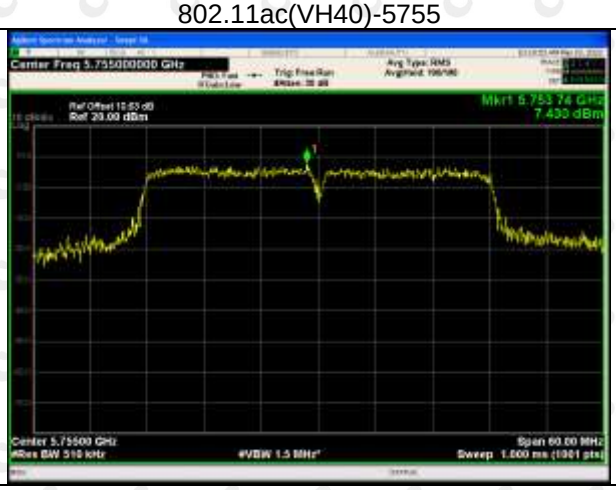


802.11ac(VH20)-5825

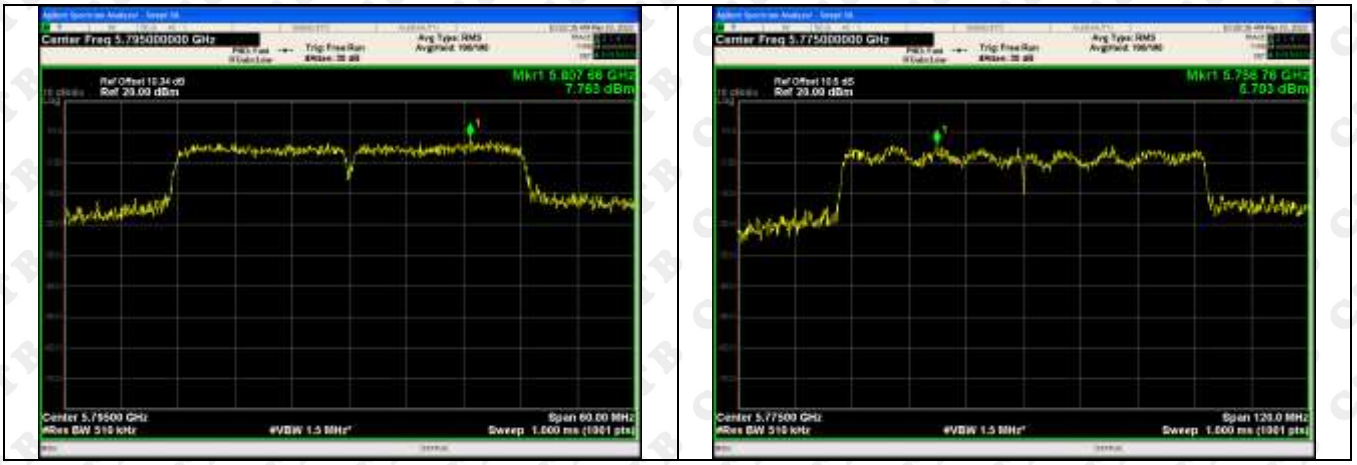
802.11ac(VH40)-5755



802.11ac(VH40)-5795

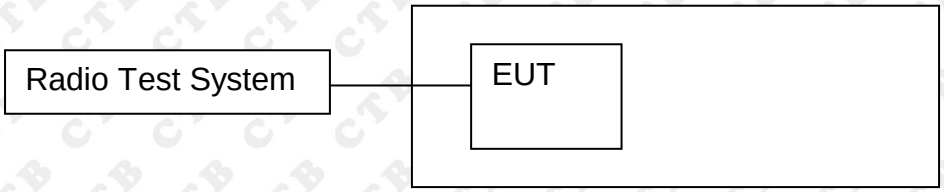


802.11ac(VH80)-5775


Center Freq 5.795000000 GHz
Ref Offset 10.34 dB
Ref 20.00 dBm
Mkr1 5.807 68 GHz
7.783 dBm
Center 5.79500 GHz
#Res BW 510 kHz
#VBW 1.5 MHz*
Span 60.00 MHz
Sweep 1.000 ms (1001 pts)
Center Freq 5.775000000 GHz
Ref Offset 10.5 dB
Ref 20.00 dBm
Mkr1 5.758 76 GHz
6.703 dBm
Center 5.77500 GHz
#Res BW 510 kHz
#VBW 1.5 MHz*
Span 120.0 MHz
Sweep 1.000 ms (1001 pts)

12. FREQUENCY STABILITY

12.1 Block Diagram Of Test Setup



12.2 Limit

Manufacturers of U-NII devices are responsible for ensuring frequency stability such that an emission is maintained within the band of operation under all conditions of normal operation as specified in the user's manual.

12.3 Test procedure

1. The EUT was placed inside temperature chamber and powered and powered by nominal DC voltage.

2. Set EUT as normal operation.

3. Turn the EUT on and couple its output to spectrum.

4. Turn the EUT off and set the chamber to the highest temperature specified.

5. Allow sufficient time (approximately 30 min) for the temperature of the chamber to stabilize, turn the EUT and measure the operating frequency.

6. Repeat step with the temperature chamber set to the lowest temperature.

12.4 Test Result

TX Frequency (5180-5240MHz)

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5180.0464	5180	0.0464	8.9575
		V max (V)	132	5180.0437	5180	0.0437	8.4363
		V min (V)	108	5180.0465	5180	0.0465	8.9768
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5180MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5180.0449	5180	0.0449	8.6680
		T (°C)	-10	5180.0454	5180	0.0454	8.7645
		T (°C)	0	5180.0431	5180	0.0431	8.3205
		T (°C)	10	5180.0475	5180	0.0475	9.1699
		T (°C)	20	5180.0492	5180	0.0492	9.4981
		T (°C)	30	5180.0484	5180	0.0484	9.3436
		T (°C)	40	5180.0444	5180	0.0444	8.5714
		T (°C)	50	5180.0476	5180	0.0476	9.1892
		T (°C)	60	5180.0490	5180	0.0490	9.4595
		T (°C)	70	5180.0414	5180	0.0414	7.9923
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5200.0436	5200	0.0436	8.3846
		V max (V)	132	5200.0422	5200	0.0422	8.1154
		V min (V)	108	5200.0469	5200	0.0469	9.0192
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5200MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5200.0432	5200	0.0432	8.3077
		T (°C)	-10	5200.0423	5200	0.0423	8.1346
		T (°C)	0	5200.0424	5200	0.0424	8.1538
		T (°C)	10	5200.0421	5200	0.0421	8.0962
		T (°C)	20	5200.0425	5200	0.0425	8.1731
		T (°C)	30	5200.0428	5200	0.0428	8.2308
		T (°C)	40	5200.0435	5200	0.0435	8.3654
		T (°C)	50	5200.0417	5200	0.0417	8.0192
		T (°C)	60	5200.0398	5200	0.0398	7.6538
		T (°C)	70	5200.0423	5200	0.0423	8.1346
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5240.0432	5240	0.0432	8.2443
		V max (V)	132	5240.0413	5240	0.0413	7.8817
		V min (V)	108	5240.0398	5240	0.0398	7.5954
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5240MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5240.0488	5240	0.0488	9.3130
		T (°C)	-10	5240.0434	5240	0.0434	8.2824
		T (°C)	0	5240.0432	5240	0.0432	8.2443
		T (°C)	10	5240.0458	5240	0.0458	8.7405
		T (°C)	20	5240.0429	5240	0.0429	8.1870
		T (°C)	30	5240.0426	5240	0.0426	8.1298
		T (°C)	40	5240.0483	5240	0.0483	9.2176
		T (°C)	50	5240.0496	5240	0.0496	9.4656
		T (°C)	60	5240.0483	5240	0.0483	9.2176
		T (°C)	70	5240.0413	5240	0.0413	7.8817
Limits				±20ppm			
Result				Complies			

TX Frequency (5725-5850MHz)

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5745.0424	5745	0.0424	7.3803
		V max (V)	132	5745.0445	5745	0.0445	7.7459
		V min (V)	108	5745.0432	5745	0.0432	7.5196
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5745MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5745.0457	5745	0.0457	7.9547
		T (°C)	-10	5745.0403	5745	0.0403	7.0148
		T (°C)	0	5745.0424	5745	0.0424	7.3803
		T (°C)	10	5745.0478	5745	0.0478	8.3203
		T (°C)	20	5745.0483	5745	0.0483	8.4073
		T (°C)	30	5745.0420	5745	0.0420	7.3107
		T (°C)	40	5745.0415	5745	0.0415	7.2237
		T (°C)	50	5745.0496	5745	0.0496	8.6336
		T (°C)	60	5745.0409	5745	0.0409	7.1192
		T (°C)	70	5745.0498	5745	0.0498	8.6684
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5785.0458	5785	0.0458	7.9170
		V max (V)	132	5785.0425	5785	0.0425	7.3466
		V min (V)	108	5785.0484	5785	0.0484	8.3665
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5785MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5785.0488	5785	0.0488	8.4356
		T (°C)	-10	5785.0445	5785	0.0445	7.6923
		T (°C)	0	5785.0476	5785	0.0476	8.2282
		T (°C)	10	5785.0439	5785	0.0439	7.5886
		T (°C)	20	5785.0442	5785	0.0442	7.6404
		T (°C)	30	5785.0425	5785	0.0425	7.3466
		T (°C)	40	5785.0445	5785	0.0445	7.6923
		T (°C)	50	5785.0423	5785	0.0423	7.3120
		T (°C)	60	5785.0426	5785	0.0426	7.3639
		T (°C)	70	5785.0485	5785	0.0485	8.3838
Limits				±20ppm			
Result				Complies			

Voltage vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
T nom (°C)	20	V nom (V)	120	5825.0433	5825	0.0433	7.4335
		V max (V)	132	5825.0415	5825	0.0415	7.1245
		V min (V)	108	5825.0437	5825	0.0437	7.5021
Limits				±20ppm			
Result				Complies			

Temperature vs. Frequency Stability

TEST CONDITIONS				Reference Frequency：5825MHz			
				f	fc	Max. Deviation (MHz)	Max. Deviation (ppm)
V nom (V)	120	T (°C)	-20	5825.0439	5825	0.0439	7.5365
		T (°C)	-10	5825.0434	5825	0.0434	7.4506
		T (°C)	0	5825.0455	5825	0.0455	7.8112
		T (°C)	10	5825.0484	5825	0.0484	8.3090
		T (°C)	20	5825.0425	5825	0.0425	7.2961
		T (°C)	30	5825.0419	5825	0.0419	7.1931
		T (°C)	40	5825.0454	5825	0.0454	7.7940
		T (°C)	50	5825.0486	5825	0.0486	8.3433
		T (°C)	60	5825.0445	5825	0.0445	7.6395
		T (°C)	70	5825.0403	5825	0.0403	6.9185
Limits				±20ppm			
Result				Complies			

13. OPERATION IN THE ABSENCE OF INFORMATION TO THE TRANSMIT

13.1 Requirement

15.407(c) requirement:
The device shall automatically discontinue transmission in case of either absence of information to transmit or operational failure. These provisions are not intended to preclude the transmission of control or signal ling information or the use of repetitive codes used by certain digital technologies to complete frame or burst intervals. Applicants shall include in their application for equipment authorization a description of how this requirement is met.

13.2 Test Results

Operation in the absence of information to the transmit:

While the EUT is not transmitting any information, the EUT can automatically discontinue transmission and become standby mode for power saving. The EUT can detect the controlling
signal of ASK message transmitting from remote device and verify whether it shall resend or
discontinue transmission. (manufacturer declare)

14. ANTENNA REQUIREMENT

15.203 requirement:

An intentional radiator shall be designed to ensure that no antenna other than that furnished by the responsible party shall be used with the device. The use of a permanently attached antenna or of an antenna that uses a unique coupling to the intentional radiator, the manufacturer may design the unit so that a broken antenna can be replaced by the user, but the use of a standard antenna jack or electrical connector is prohibited.

EUT Antenna:

The antenna is External Antenna and no consideration of replacement. The best case gain of the antenna is 1.0dBi.

15. EUT PHOTOGRAPHS

EUT Photo 1

EUT Photo 2

16. EUT TEST SETUP PHOTOGRAPHS

Radiated Emission

Below 1G

Above 1G

Conducted emissions

※※※※※ END OF REPORT ※※※※※